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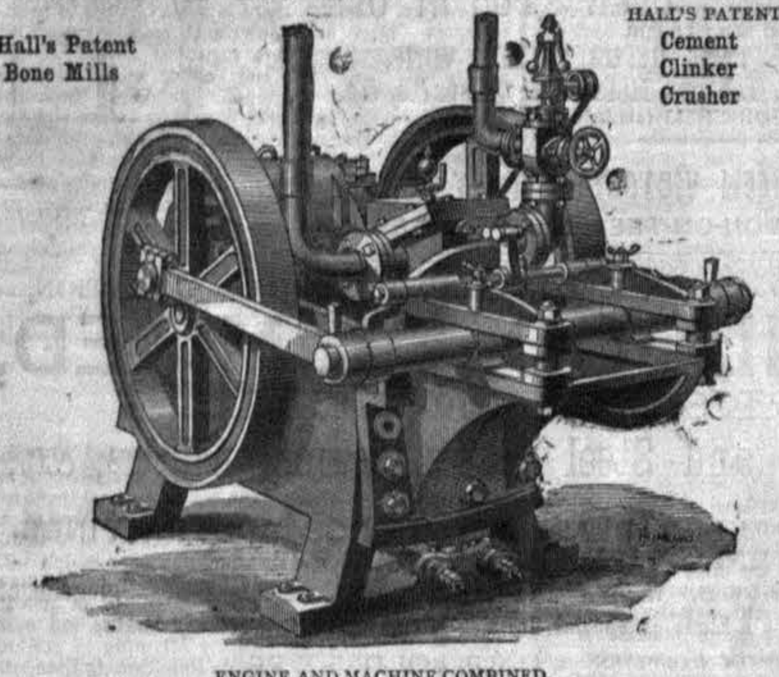

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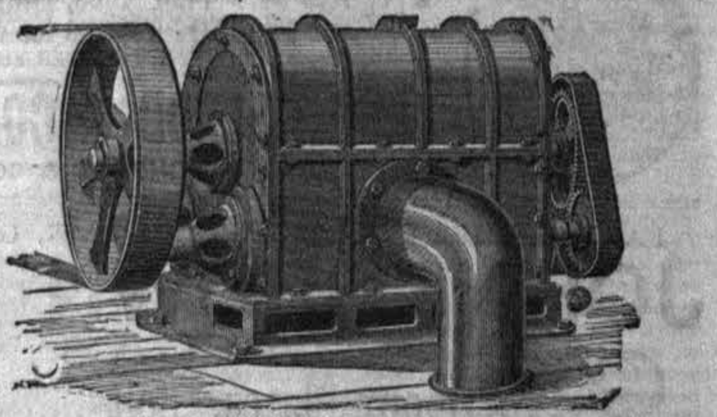

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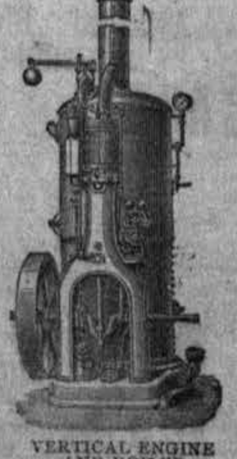

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IRON.

LONDON, FRIDAY, MARCH 12, 1880.

THE BURSTING OF A 100-TON GUN.

SCARCELY fourteen months have elapsed since the accidental bursting of one of our own heavy naval guns occurred during practice, and now we are startled by a similar occurrence with a much heavier gun, under similar circumstances, on board an iron-clad belonging to a foreign Power. It is, however, gratifying to know that in the present instance no fatal consequences have, up to the present, ensued, and it is to be hoped that the wounded sufferers will speedily recover. The interest in the bursting of the *Thunderer's* 38-ton gun having been maintained ever since the fatal occurrence down to the present time, probably serves to bring into greater prominence the disaster to the 100-ton gun of the *Duilio* which happened at Spezia on the 6th instant, on which day the experiments with that weapon were to be brought to a close. The recent experiments at Woolwich, if they did not prove that the *Thunderer's* first gun was burst by being doubly-loaded, at any rate went to show that the accident might have happened from that cause. In the case of the *Duilio*, however, the clearest evidence is afforded by those present that the gun was only singly-loaded. That single charge, however, was sufficient to prove fatal to the integrity of the weapon. About 156 rounds in all have been fired from the Armstrong 100-ton guns during various experiments at Spezia, and the result has been to decide on different charges, the powder being Italian, and called "Fossano powder." The ordinary service charge for comparatively light work consists of 363 English pounds of this powder, the initial velocity being 1280 feet per second. There has been for purposes of experiment an intermediate charge of 485 lb., which gives a velocity of 1520 feet per second. The battering charge to be used when the full power of the gun is to be called into play has 551 lb. of powder, and gives to the shot, which weighs 2000 lb., a velocity of 1706 feet per second, and this was the charge which was used when the gun gave out.

From what has transpired since the accident, it would seem that during the two days prior to the 6th inst., thirteen rounds had been fired from the guns on board the *Duilio* in order to test not the guns themselves but their working accessories, for the guns had passed muster and were considered to be beyond all suspicion. Upon the day of the accident, it appears that the smoothness of the working of every detail during the process of loading was remarkable, except in the case of the ill-fated gun, in which the shot partly stuck, and had to be rammed home by blows from a hand rammer. This gun was in the aft turret, and only one round was fired from it, and that was the fatal one. Upon the occasion in question, when the gun was fired, nine persons were present in the *Duilio's* turret. To those on the deck the first intimation of the mishap was a shower of bolt heads, a number of burning grains of powder being projected from the gun on to the deck. The next intimation was the observed strange position of the muzzle of the gun, which was immoderately depressed, and the emergence from the roof of the turret of the wounded officers and men, accompanied by wreaths of smoke. Upon examination it was found that the roof of the turret was raised and broken, and that the wall behind the guns, with its 22-inch solid steel plates, showed a rift which had been torn open from within. The muzzle of the gun, although depressed, had not moved forward, and it was soon seen that the gun had not burst, in the ordinary acceptation of the term. The interior steel tube had been entirely fractured across the point where the enlarged powder-chamber begins to slope towards the smaller part of the bore—the shoulder of the powder-chamber, as it may be called. The rest of the gun, composed of several tubes of coiled wrought iron, had simply disengaged itself, and the tubes apparently were not broken in the slightest degree. The whole of the muzzle, together with the trunnions, and the coils immediately behind the trunnions, even including the inner one which surrounds the steel tube, remained fixed by the trunnions to the carriage. The only movement of this mass had been the depression of the muzzle. The rest of the gun, including the whole of the breech, containing the rear part of the steel tube, from the shoulder of the powder-chamber backwards, had separated itself from the muzzle portion, and, being unsupported, had yielded to the force of the discharged powder and been dashed backwards against the wall of the turret, displacing two of the plates, cracking the steel lining, and crushing the heavy wooden backing through the gap made between the two plates.

Such, in effect, is the account given by one who was present at this remarkable accident, which indicates that the longitudinal construction of the gun is deficient in strength, or else that the enlarged powder-chamber is liable to a longitudinal strain which has not been sufficiently provided for. It should, however, be borne in mind that it is a long time since these guns were ordered of Sir William Armstrong's firm. The contract was that the guns should produce a certain effect, which they did with an initial velocity some 300 feet less than that which is now given to the projectile. Since the date of the order the use of enlarged powder-chambers has been introduced, and it is stated that the tubes were bought and for the most part manufactured before there was any idea of enlarging the powder-chamber. It may, therefore, be that the steel is not thick enough at the breech end, and that the pressure of shrinkage over the tube, where it is thinned by the powder-chamber, may have compressed it more than at the thicker part, thus creating unequal tensions, which would meet at the shoulder of the chamber, and prepare the tube for rupture at that point. The fracture of the steel tube is said to be perfectly clean, and to have occurred just at the commencement of the front cone of the chamber. As the guns were not originally made for chambers, but were altered afterwards to meet the latest developments of science, the accident may be of use in showing the danger of chambering old guns not designed for the purpose.

It would thus appear that the gun has not burst with violence as did the *Thunderer's* gun, that is, it has not been blown into fragments, but has separated into two portions, the shot having, no doubt, left the gun before the separation took place; otherwise, not a man would have escaped with his life. The occurrence, however, will none the less have the effect of directing renewed attention to the subject of heavy ordnance; the more in that we are the possessors of four 100-ton guns of precisely similar make and pattern. Although the accidental failure of two guns out of a large number of the classes to which they belong is, perhaps, insufficient to cause the utter condemnation of the systems upon which they are constructed, it nevertheless affords ample proof of the necessity for a rigidly careful enquiry into the principles of those systems, especially in the face of what we know respecting the practice with Whitworth, Palliser, and other guns, and in view of the contemplated introduction of steel as the exclusive material for our heavy ordnance. At the same time we do not forget that there is steel *and* steel.

OUR TRADE SUMMARY.

THE most sanguine views of the prospects of trade, and of our own department in particular, may be considered as confirmed by the returns of the Board of Trade, of which the portion of special interest to our readers is republished in our present number. The recovery in iron is most notable in comparison with all the great departments of our export trade; the improvement in iron and steel, as compared with last year, being fully 90 per cent., whilst that in worsted stuffs is only about 10, and in cotton piece goods 40 per cent. There is one drawback to this good fortune, and that is the presence of outside speculation, which has been especially evident in the Glasgow warrant market during the week. There has been a severe drop in prices in that market and buyers are holding back in expectation of a still further reduction. Meanwhile, although the Americans are beginning again to buy, there are few inquiries in Glasgow from any other quarter. The closing prices on Wednesday ranged from 60s. to 60s. 10d. and a little over. Makers' prices have also fallen considerably, with little business doing. Quietness likewise prevails in the manufactured trade, as well as in engineering and ironfounding; but the shipbuilders continue well employed. At Middlesborough, on Tuesday, prices were down to 57s. in some cases, and even lower terms were named. The finished-iron trade on the Tees, and the ironfoundries of the same district, are doing fairly well; but trade disputes continue to interfere with the progress of the shipbuilding industry. Similar reports with respect to crude iron reach us from other districts of the North-east, chiefly resulting in sympathy with the movement in Glasgow. In manufactured qualities there is considerable briskness, and new furnaces have been blown in, or are about to be; and in plate and other works in the Newcastle district there is great activity, checked in some of the larger establishments by a short supply of iron. The temporary lull or reaction in the pig-iron trade has reached the hematite districts of the North-west; but this little affects makers, owing to the extent to which they are sold forward, and nobody expects the drop to last for any length of time, so that the quotations have not been perceptibly altered. It is significant also, that, notwithstanding this slackness, there is no abatement in the efforts being made to increase the output by the re-lighting of furnaces, which is going on on every hand. The minor iron industries of the district continue to be fairly, and, in most instances, busily, employed. The pig-iron market at Manchester was dull, mainly, as in the others, owing to the downward movement in Scotch, intensified by the suspension in the foreign demand, and what business was effected was done at comparatively low figures. Finished-iron makers are generally busy, without much change in rates, and the long-delayed improvement in the local cotton trade is benefiting the machinists and engineers. Of the smaller and less productive districts it may be said that, except in one or two cases, they follow suit with the larger. There is little change to report in the output of pig in South Yorkshire, but the market participates in the unsettled condition prevailing everywhere, although there is little change in prices to report. Here, as elsewhere, it may be remarked, the prevailing quietness is regarded as only a temporary lull. The plate and rolling mills, however, continue actively employed. In West Yorkshire matters remain generally as they were. From Staffordshire the reports are to much the same effect. The superior ores of the Forest of Dean continue in active demand, and the majority of the suspended mines either are, or are about to be, re-opened. A somewhat general improvement is noted in the local trades of Sheffield; but the Birmingham hardware branches are still without material amendment. In the Wolverhampton district there is more activity, but prices keep low. The coal trade is dull everywhere; but there is considerable animation in the coke manufacture.

COLD LIGHT.

THERE are many operations connected with industrial pursuits in which the employment of artificial light is an absolute necessity, and there are conditions under which such light, if deprived of its dangerous attribute, heat, would prove of inestimable value. Amongst the many purposes for which such a light might be advantageously utilised, we have only to mention the working in mines, in powder magazines, and in ships' holds, stores, and other smaller compartments. Many attempts to produce such a light have been made from time to time, and to a certain limited extent some have succeeded, although hardly in a practical sense. In 1864 MM. Dumas and Benoit introduced Geissler's tubes for this purpose into several French collieries, with some success, the battery arrangements being modified to suit the intended purpose. Since then we have had several attempts to produce what we may term a "cold light" by means of agents possessing phosphorescent powers. Amongst others who have devoted years to the study of the question is Mr. W. H. Balmain, who was a manufacturing chemist of St. Helen's, Lancashire. That gentleman succeeded in producing a compound which in some points resembles paint, and inasmuch as it becomes highly luminous in the dark, it has received the name of "luminous paint." It is, however, to be regretted that Mr. Balmain did not long survive the fruition of his ideas, he having recently died.

With regard to the composition of this paint we can only say that its components are chiefly lime and sulphur, the remarkable results of their combination being the effect of special manipulation. We know that the sulphides of lime and baryta and some kinds of marine shells become luminous in the dark after having been exposed to the daylight for a short time. It was precisely on these lines that Mr. Balmain worked, and he succeeded in producing a compound which can be painted over any surfaces, and which, after exposure to light for a few minutes, becomes highly luminous when taken into a darkened apartment. It will retain its luminosity for about six hours, after which it must be again exposed to the light in order that it may absorb a fresh supply of rays to be afterwards usefully given off in darkness. The precise nature of the luminous ingredients are not known to us, but they are stated to be produced from the chalk of our cliffs. Whatever they may be they are simply compounded with the usual carriers of ordinary paints, and are similarly applied. We recently had the opportunity of inspecting a number of articles prepared with this paint, which after having been exposed to daylight for a few minutes, gave forth in a darkened room a beautiful soft violet light, sufficient in some cases to enable any object in the apartment to be clearly distinguished. Should it be necessary to revivify the luminous object at night, it can be done by burning a few inches of magnesium ribbon in front of it. The explanation of these phenomena, perhaps, is that the molecules of the sensitive salt are put into vibration by the waves of light impinging upon them, and that the vibration continues long after the motive light is withdrawn, an action being set up which affects the eye in the same way as the vibrations of a bell struck by a hammer affect the ear.

The applications of which this remarkable invention is susceptible are very numerous, as was evidenced at the demonstration to which we have referred, and which took place at the offices of Messrs. Ihlee and Horne, of 31, Aldermanbury, London, and who are the agents for the invention. Amongst other things we may mention its use on life-buoys, which are thus rendered useful at night, and for lighting up the lower compartments of ironclads, for which and similar purposes the Lords of the Admiralty have the matter under their consideration. Divers will also find it useful in their sub-aqueous operations. In fact, a diver recently

SEMI-PORTABLE ENGINE WITH REMOVABLE FIRE-BOX AND TUBES.

BY M. HERMANN-LACHAPELLE, PARIS.

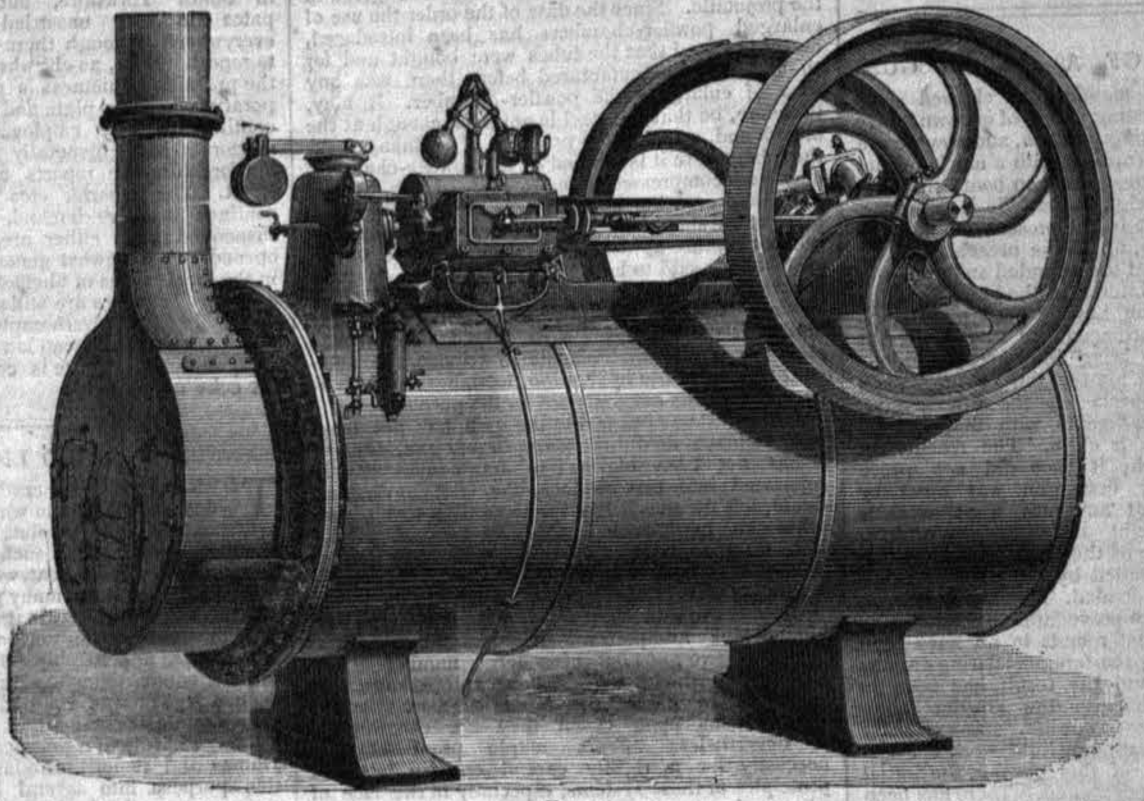


Fig. 1.

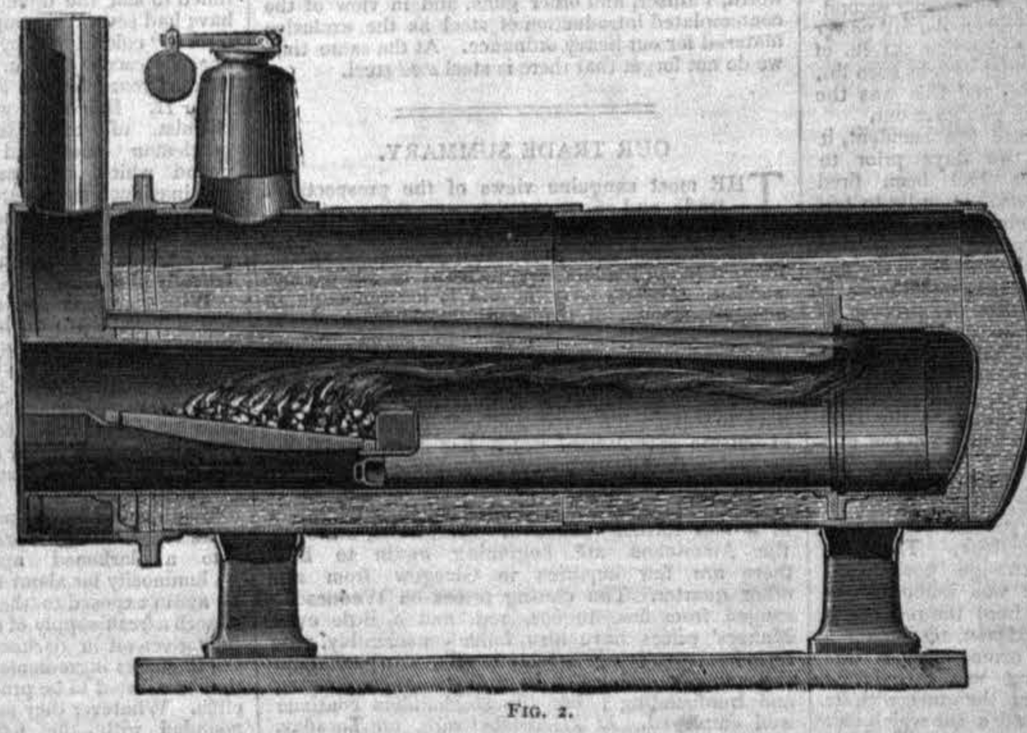


Fig. 2.

found it of great assistance to him in 27 feet of water in the Southampton Docks, his dress and head-gear having been coated with the luminous paint. As a means of affording light in a portable form the luminous paint is applied on sheets of glass of various sizes which have received the name of Aladdin's lamps, and which are in use on board some of our ironclads and in the spirit vaults of some railways. In fine, we deem this invention to be one possessing great merit, and one, moreover, which can hardly fail to prove a practical success, inasmuch as it supplies the desideratum of cold light.

SEMI-PORTABLE ENGINE.

IN noticing the portable engines exhibited at the Paris Cattle Show, we commented on the system, prevalent on the Continent, of connecting the flue to the shell by an annular joint, so that the flue and tubes may readily be withdrawn for cleaning, inspection and repairs. The portable and semi-portable engines, alike in that respect, shown by MM. J. Boulet et Cie, the successors to the well-known firm of Hermann-Lechapelle, Paris, are constructed on this principle; and we now illustrate their semi-portable engine, in the accompanying engravings, by a perspective view at fig. 1, and a longitudinal section of the boiler at fig. 2. This firm, unlike most makers of engines in Paris, are also boiler-makers, so that they are enabled to pay the requisite attention to a suitable selection of plates and construction. Referring to fig. 2, it will be seen that the flue is connected, at the furnace end, to the front tube-plate, which is riveted to an angle-iron ring; and this latter is bolted in turn to an angle-iron ring riveted to the shell. The other end of the flue is connected by the back tube-plate to a combustion chamber, not attached to the shell, so that the flue, with the tubes which surround it at the top and sides, is perfectly free to expand and contract without straining itself or the shell. It is asserted that, by causing the hot gases to return by the tubes before ascending the chimney, all practical heat is extracted from them. The joint between the angle-iron rings of the flue and the shell is made with an annular washer of indiarubber, which, as it is subjected to no great degree of heat, may be used two or three times over. The flue and tubes are drawn out by tackle on to rollers placed in front of the boiler, and after cleaning, which is thus made an easy operation, are pushed back again, when all that is required is to screw up the nuts of the joint. The same principle of avoiding strain is carried out in the engine, the cylinder being bolted to a saddle which, with the plummer blocks cast in the same piece, is simply placed on the upper surface of the boiler, and may be removed at will and used as a stationary enigne, while the boiler continues to supply steam for any other purpose. In all powers above 4 horse-power, the expansion is made variable by hand, as shown in fig. 1; but for 12 horse-power and upwards it is made variable by the governor, which is on Andrade's isochronous principle. The cylinder is steam-jacketed; and the piston kept tight by the expansion of two cast-iron rings. The rods, which are of good length, and the shaft, are forged out of steel ingots; and the two fly-wheels serve as driving pulleys. The pump, which is of gun-metal, draws, from a tank connected to the boiler, the feed-water heated by the exhaust steam. The 40 horse-power engine and boilers can be worked up to 55 horse-power, weigh 14 tons, and have a heating surface of 39 square metres (420 square feet), and consume from 2 to 4 kilogrammes (4·4 to 8·8 lb.) of fuel per horse-power per hour, with an evaporation of 15 to 20 litres (3 to 4 gallons) of water. It is claimed that this system fulfils all the following conditions, acknowledged to be indispensable in a portable engine:—The cylinder is steam-jacketed; the expansion is variable according to the load; the exhaust steam increases the draught and heats the feed water; and the fire-grate is arranged so as to permit of perfect combustion, to utilise all the heat given out by the fuel, and, at need, to burn any kind of fuel.

THE WERDERMANN ELECTRIC LIGHT.

AT the time when new systems of electric lighting were being introduced to the public in somewhat more rapid succession than they are at present, and which was about eighteen months since, we described, amongst others, the Werdermann light.[*] As we stated at the time, this light, although then not quite perfected as regards details, was one of considerable promise, and the period intervening between our previous notice and the present one has been advantageously occupied in working out its details to a very successful issue. Several modifications and improvements have been introduced in the system, which have rendered it in many respects a much more practical means of illumination than it previously was. Having recently been afforded the opportunity of inspecting the Werdermann Light in its improved condition, we propose placing particulars before our readers. We may premise that the demonstration was carried out at the ironworks and wharf of Messrs. Rownson, Drew and Co., Upper Ground Street, Blackfriars Bridge, where nine of these lights have been in successful use for some little time past. The demonstration took place in the presence of a number of scientific gentlemen and others interested in the question. It was conducted by Mr. Henry F. Joel, C.E., on behalf of the Signal Engineering Company, of 171, Queen Victoria Street, London, and was in every way a success.

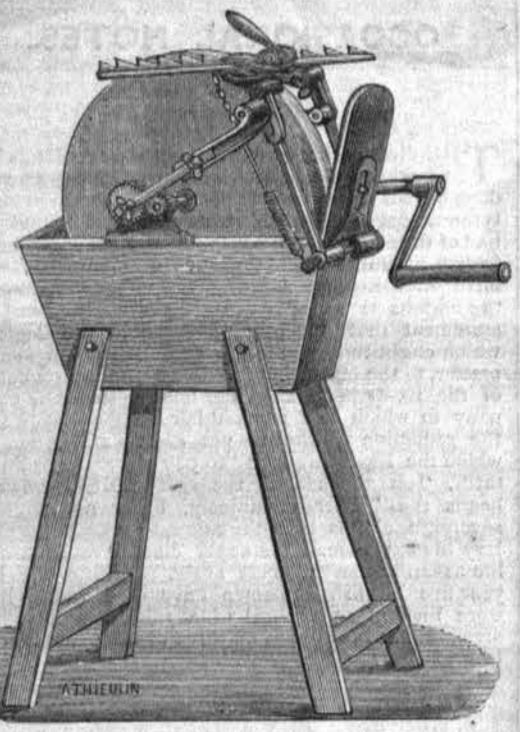
In order to render clear to our readers the improvements that have been made in the system it will be best for us to describe it briefly as it existed at the date of our previous article. It will doubtless be remembered that as originally constructed, the lamp consisted of a carbon pencil placed vertically point upwards and impinging upon the underside of a disc of carbon placed horizontally, and forming the negative electrode of the lamp. The disc was about 2 inches in diameter and 1 inch in thickness, the carbon pencil being rather more than one-eighth of an inch in diameter and of any convenient length, about 18 inches being the normal length adopted. The pencil was held vertically under the disc in a guide, its lower end being fitted in a small holder to which a pair of fine cords were attached. These cords were led up over pulleys and down again to a small counterbalance weight, and as the carbon rod was free to move in its guide its point was always held up against the underside of the disc with a gentle pressure. By this means the consumption of the carbon rod was uniformly and easily followed up. The same general principles and arrangements are preserved in the improved form of Werdermann light, its details only having been modified. The current, which is continuous, is still divided, and is conducted to the lamps through a main cable, but without the branches leading to each lamp which were formerly adopted. There is, too, still the power of extinguishing any one or more lamps of the series without affecting the rest. The first point of departure is the substitution of a disc of copper for that of carbon, which was formerly used, and which answers its intended purpose equally as well as the carbon electrode. It is of the same diameter as was the carbon disc; but, unlike its predecessor, it is not consumed, while it produces an equally effective light. The carbon pencil impinges upon its underside as it did on the under side of the carbon disc. It will be seen that by this arrange- M. Werdermann has been the first to depart from the usual track in that his electrodes are always in close contact. He has discarded the electric arc space, not deeming it essential that a certain definite interval should exist between the carbons, and he thereby produces what to all intents and purposes is a light of incandescence.

The next important feature is a new automatic arrangement, by means of which the carbon, in rising, regulates the contact pressure on itself. To this end, the copper disc is made movable, and capable of being pressed upwards by the carbon beneath it. The copper disc is hinged or pivoted so as to slightly overbalance at the front, where it impinges upon the carbon pencil. Attached to the rear of the disc is a flat spring which is pressed against one side of the copper nipples, through which the carbon pencil passes, by the upward pressure of the pencil acting upon the disc, the side of the nipple against which the spring presses being hinged. This constitutes an automatic adjustment and re-adjustment of the pressure on the carbon pencil, so that if by any chance the carbon should stick fast—as formerly it occasionally did—the pencil is consumed at the top, and the copper electrode follows it down, thus releasing the spring, relieving the pressure on the nipples, and freeing the carbon pencil.

The result of this modification is that the light can now be burned in series with an intensity current, whereas, formerly, the sticking of the carbon pencil prevented the lights being joined up in one circuit. Hence the conductor is now made continuous, instead of having branches, as formerly. A quantity current then had to be used, which, as is well known, requires a greater power to generate than an intensity current. Altogether, these improvements have, as we have already observed, made the Werdermann system much more practicable than it formerly was, while a much steadier light is now obtained. In its improved form this system has been successfully applied to lighting a factory in Manchester, as well as at Messrs. Rownson and Drew's works. In the demonstration which was given at the latter establishment eight lamps of various designs were placed on a circuit, each giving an estimated light of about 200 candles, the current being supplied from a Gramme continuous machine, which was driven from the surplus power of the 8-horse engine used for driving punching and other machines on the works. This engine also drives the machine for producing the current for the electric light ordinarily used in the works. The results of the demonstration went to show that the light is well adapted for use in warehouses, workshops, and other large interiors. We understand that Major Festing, R.E., having tried the Werdermann light in the old library of the South Kensington Museum, purposes recommending its adoption in the new one which is now in course of construction. On the whole we may congratulate M. Werdermann upon having succeeded in dividing the electric current in an effectual manner, and in producing a practical and steady white light of moderate power.

GRINDSTONE ATTACHMENTS FOR REAPER KNIVES.

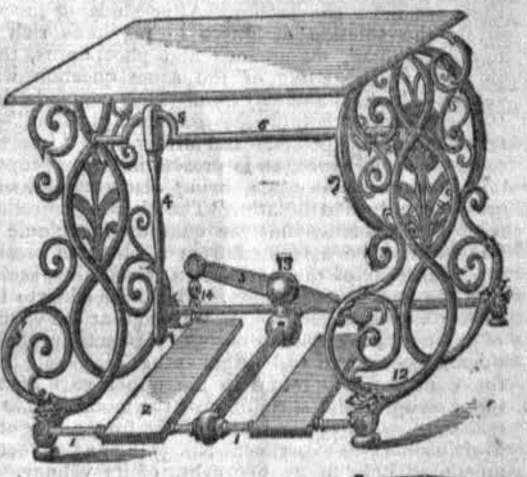
AT the recent Paris Cattle Show, most of the grindstones exhibited were on the American model, not frequently seen in England, that is to say, with the handle at right angles to the spindle, a pair of bevel pinions communicating the motion. This arrangement is adopted by M. Guedon-Fois, of Amiens, whose new attachment for grinding the knives of reapers and mowers, shown in the annexed engraving, attracted much attention, and was, we believe, at once secured by an English firm. It will be seen that a pinion on the offside of the stone gears with a larger pinion provided with a crank-pin, which, by means of a connecting-rod, gives a reciprocating motion to a link, thus causing the knives to travel on the stone in the same way as when held by the hand, a spiral spring keeping its edge against the stone. The beveled edge of the grindstone sharpens one side each of adjacent teeth at once; and all that the man turning the stone has to do is to advance the knife, tooth by tooth, from time to time. MM. Rigault et Cie., Paris, showed a new attachment fitted to a stone with beveled edge, turned in the ordinary manner. The cast-iron trough is provided with lugs having vertical holes, one on each side; and in them swivel standards like the tool rests of a hand lathe. A slot in the outer end of the "rest" permits of a clamp holding the knife to be fixed by a thumbscrew. In this manner one side of all the teeth is brought successively up to the edge, by the hand not engaged in turning the stone; the attachment is then transferred to the hole at the other side of the trough, and the operation repeated for the remaining sides of the teeth.



DRIVING SEWING MACHINES.

THE accompanying engraving represents some improvements which have been made in mechanism for driving sewing machines and for similar purposes, by Mr. T. S. Tongue, of Birmingham. Fig. 1 illustrates the application of this mechanism to a sewing machine stand. 1 represents the fulcrum bar of two treadles, 2, and which are arranged at the front of the frame or stand, 12, leading the treadles therefrom rearwards or away from the operator, that is, in the reverse direction to the usual arrangement; and 3 represents a beam which is centred as at 13, at the rear of the frame or stand between and at right angles to the treadles, and which is connected thereto by links, 14, so as to be oscillated thereby. From the rear end of one of the treadles rises a connecting rod, 4, which is attached to a crank, 5, on the driving shaft, 6, which is thus actuated. On the shaft, 6, are two wheels (7, 8,), a fly-wheel, 7, which is fast upon it, and a driving wheel, 8, for actuating the sewing machine, which runs loose thereon except when brought into action by the fly-wheel. The boss of the driving wheel 8 (or of the fly-wheel, as may be preferable in some machinery), is recessed and fitted, as shown in fig. 2, with a turned ring of square iron, 9, (shown detached in fig. 3), and which is cut across or slotted to receive a small wedge, 10, which is acted upon by two pegs, 11, set eccentrically upon the disc of the fly-wheel, 7, which comes against and closes the recessed face of the driving wheel in such a manner (as shown in fig. 4) that the outermost (or innermost) pin, on striking the wedge, springs the ring and locks both the wheels together, thus causing the machine to be driven, whilst the other pin reverses and frees the ring. For moving the machine in the reverse direction the fly-wheel turns, leaving the driving wheel loose on its shaft. The driving wheel being thus either fast or loose upon its shaft at the will of the operator, he is enabled to wind the cotton for shuttles or on spools without driving the machine. By the application of the above described driving mechanism to such and other similar purposes, the driving and action is rendered much less laborious than hitherto, the beam being situated with its treadles at the rear of the machine in lieu of the front, the latter being too direct a motion and tiring and difficult to work, but by transferring them to the position described motion is imparted and sustained with greater ease and facility.

FIG. 1.



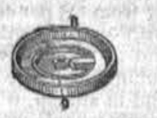


FIG. 2.

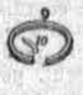


FIG. 3.

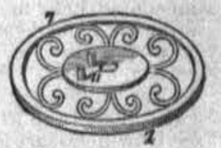


FIG. 4.

ON DR. MULLER'S EXPERIMENTS ON THE ABSORPTION OF GASES BY STEEL.[*]

By M. A. POURCEL.

WITH reference to Mr. Mushet's letter recently published in IRON, a translation of which is printed in the proceedings of this Society for the current month, I regret that the details are still wanting of the experiment therein recorded, by which pig-iron containing 1·50 per cent. of phosphorus was dephosphorised in an ordinary converter simply by means of hammer slag (*battitures de fer*) injected with the blast. Possibly I may find in the details of this experiment some practical proof in support of the opinion I have already advanced, and which has met with so much hostile criticism:—"That in the first period of the Bessemer process, as in the operation of refining, it is possible to eliminate phosphorus by the addition of oxide of iron." Respecting the experiments of Dr. Müller, published by the *Union Industrielle*, and inserted in the last number of the proceedings of this society, I am not in accord with the editor of the article in thinking that they completely upset the hypothesis admitted up to the present day, as he says, that the gases contained in steel were only carbonic oxide and carbonic acid; and the conclusion "that in consequence of this error the steelmaker must have received lots of advice of little practical value," is, of course, but too evident

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[*] See IRON, vol. xii., p. 555.

[*] Paper read before the Société de l'Industrie Minérale.

This pretended error, however, has simply been productive of consequences highly favourable to the progress of steel manufacture, and errors in science do not generally lead to good results.

In the first place, I may say, that it has never been admitted that carbonic oxide and carbonic acid were the only gases present in steel, and if it is desirable to study the recent works of foreign savants touching this question, we should hesitate to extol them before studying those of French men of science. I beg to refer the members of this society who take an interest in the subject, to the remarkable article of Messrs. L. Troost and P. Hautefeuille, published in the year 1876 in the "Annales de Chimie et de Physique," vol vii., page 155. The works of the predecessors of Messrs. Troost and Hautefeuille, viz., Graham, Colonel Caron, M. Sainte-Claire Deville, &c., are there recorded. The experiments of these two savants are stated in the clearest possible manner, and the conclusions which they draw from them are most convincing. After studying successively the solution of gases in pig-irons rich in carbon, silicon, manganese and phosphorus, they proceed to the study of the same question with reference to steel and soft iron. They conclude that "Steel dissolves notably less gas than pig-iron,"—a result rather unexpected—and further, that "In steel, as in pig-iron, hydrogen is present in larger proportion than carbonic oxide, being also retained with greater energy than the latter." The following corrollary is at once evident, that the quantity in volume of gas that can be extracted from a block of steel is not a function of the blow-holes it contains, seeing that pig-iron absorbs more. Thus, referring to Dr. Müller's experiments No. 4, we see that the volume of gas extracted from an ingot of pig-metal probably homogeneous, and without any other blow-hole than the pocket which forms in the upper part of the ingot owing to the shrinking of the metal (*poche de retassement*) is 35 per cent., whilst from an ingot of Martin steel (see experiment No. 3) the gas extracted amounted only to 25 per cent. of its volume. I myself have made steels containing from 2·5 per cent. to 3·0 per cent. of manganese, with 0·5 per cent. of carbon, absolutely free from blow-holes, which nevertheless yielded 50 per cent. per volume of hydrogen gas. Steels rich in manganese and in silicon, without blow-holes, are generally free from carbonic oxide, but still dissolve hydrogen in proportion to the content of manganese, and, finally, phosphoric pig-iron and phosphoric steels dissolve hydrogen gas in considerable quantity with a minimum of carbonic oxide. Also steels with 0·3 per cent. of phosphorus are generally free from blow-holes, although they yield in vacuum a rather large volume of hydrogen.

As regards the presence of nitrogen in ingots of pig-iron and steel—often in very notable quantity—I will venture upon the following explanation. When an ingot of liquid steel solidifies, it passes from the density of about 6·60 to that of 7·90. A pocket or cavity (*poche de retassement*) is formed, the metal of which has gone to feed other parts of the solid, and during the solidification, no matter what care may be taken to cover in the ingot; as the metal is pervious to gas the air finds its way into the cavity, oxygen is absorbed by the iron, and the reddish colour of the walls of the cavity, which are often crystalline, is, in fact, due to oxidation; the nitrogen meanwhile remains imprisoned. It is thus that in some bars of rolled steel it has been proved that ammonia was given off abundantly from a certain point in the bar, probably corresponding with the previously mentioned cavity of the original ingot. There is nothing anomalous in the idea that nitrogen and hydrogen under pressure should combine to form ammonia. This question of the presence of ammonia in steels has been solved, either affirmatively or negatively, by a great many impartial observers.

It is quite permissible to believe that those persons who deny the presence of this gas failed to discover any in the bars of steel on which they operated, and, on the other hand, that those who affirm it really detected its presence. It may, therefore, be supposed that ammonia occurs more especially in steels high in manganese, which have the property of dissolving hydrogen gas, and of absorbing it even at a cherry red heat (800° Cent.), and that it exists, not uniformly distributed, but localised in certain parts of the test bar. Soft steels, with 0·1 per cent. to 0·2 per cent. of manganese, or hard steels high in carbon, would give off little or no ammonia. The explanation I have hazarded is only applicable to determinations of large quantities of nitrogen made on cast ingots of pig-metal or steel; but not on isolated bars of small dimensions. Nitrogen, in fact, present in all steels and in all pig-irons, only occurs in very small proportion of the total gases therein contained, as was demonstrated by M. Boussingault and Colonel Caron in their discussion with M. Frémy some twenty years ago.

To revert to Dr. Müller's experiments, I think there is not much doubt that the course of events was pretty much as follows:—Besides hydrogen, which they dissolve in the liquid state, pig-irons and steel absorb at a temperature of 800° C., without any chemical reaction which might alter their composition, a considerable quantity of this gas. Consequently, when the ingots, as they left the moulds, at a red heat, were cooled in water, they might have absorbed hydrogen proceeding from the decomposition of the water. When, then, they were drilled under water or oil, a barometric vacuum was induced in the hole made by the drill, and the gases dissolved in the metal not only in the part attacked by the tool, but also in the surrounding parts, were drawn out by the vacuum to a great extent, and escaped into the hole made by the drill. If we consider in this particular case that the drill must have traversed in each ingot the cavity resulting from the shrinking of the metal (*poche de retassement*), the axis of which coincides with that of the ingot—the volume of the space averaging about one sixth of the total volume—we thus find an explanation of the large proportion of nitrogen determined in the gases recovered by Dr. Müller in his experiments. It would be interesting to open the ingots tested by Dr. Müller, in the direction of the axis of the hole made by the drill, and to find that in the neighbourhood of the hole, there were no blow-holes, with the exception of the above mentioned cavity, A. The ingot of pig-metal would surely show this result. But beyond the question of blow-holes may not hydrogen gas, carbonic oxide and other gases, when dissolved in steel, modify its mechanical properties. We have here opened to us a field for study, which as yet has been explored but little, if at all. My own experiments are not sufficiently numerous to enable me to draw positive conclusions from them. But they have led me to believe that certain gases, the nature of which I have not yet determined, confer the same defects on steel as the presence of phosphorus; *i.e.*, brittleness when subjected to shock, without sensibly diminishing the elongation and tensile strain. I hope at some future time to go more thoroughly into the matter. Since writing the foregoing, I have received from Mr. Chernoff a work on the molecular structure of steel, translated into French by the author; and in which the results obtained by Dr. Müller are held to be very surprising and in no way to be accepted.

OCCASIONAL NOTES.

UNEASY LIES THE HEAD, &C.

THE divinity that formerly hedged about kings has vanished, and it would go hard with them nowadays but for the extremely bad ball-practice of their tyrannicidal subjects. No better illustration could be had of the extent and persistency of these wicked and foolish attempts upon the lives of monarchs, who have often little to do with the misgovernment of the nations at whose head they are set, than the statement that recently appeared in the *Figaro*, which ought to be a trustworthy authority on such a matter, to the effect that M. Rouher, acting on behalf of the Ex-empress Eugenie, claims from the company in which she assured her life for a large sum the reduction of the 10 per cent. extra premium which the Ex-empress had to pay above the ordinary tariff, "on account of the risk which crowned heads run." Her Ex-majesty, being no longer a sovereign, claims that the company has no right to levy the extra fee. The upper classes make use of life assurance on a great scale. Within the last year five English noblemen have died whose lives were insured at a total of a million and a half sterling, the insurances on three of them amounting to a million and a quarter.

VEGETATION UNDER THE ELECTRIC LIGHT.

In the State-aided Academy of Projectors at Lagada, Capt. Lemuel Gulliver was introduced to a inventor who had been eight years engaged, and expected to be so for eight years longer, in extracting sunbeams from cucumbers, which were to be put in vials hermetically sealed, and let out for horticultural purposes in raw and inclement seasons. Dr. Siemens has arrived at the result which the Laputan projector probably missed, and in a more direct manner, by means of the electric light. At a meeting, the other day, of the Royal Society, he gave a detailed account of his experiments, which are also unfinished, but the issue so far is interesting and important. He found that an electric centre of light equal to 1400 candles placed at a distance of two metres from growing plants, was apparently equal, in its effect upon the growth of plants, to the average sunlight at the present period of the year; and that plants do not seem to require rest during the night, but under the electric light remain healthy and grow continuously, even when being at the same time forced by artificial heat. These facts constitute additional evidence of the similarity of the electric and solar light, which is manifested in other ways. It is unlikely that the electric fluid will ever be used to supplement the solar beam on a large scale, but it is obviously possible that horticulturists who grow plants under glass may be greatly benefited by its application; and artificial waterfalls in gardens, either fed by diverting a stream, or drawn from water works, would easily supply the requisite power. The paper at the Royal Society received elegant illustration from a pot of budding tulips, which, placed in the full brightness of an electric lamp in the meeting-room, in about forty minutes unfolded into full bloom.

SCIENCE AND THE NATION.

In ancient times, in periods of national crisis, the first thing was to consult the oracle, or to call upon a knavish augur to interpret the omens. In these modern days, in England especially, to apply to the greatly more reliable authorities in science is about the last thing our rulers think of. The governing classes among us are notably non-scientific, and that fully accounts for the neglect of means to which recourse is largely had by the public authorities on the Continent, and especially in the States of the North American republic, in each of which there is an able scientific staff, by whom great service is being rendered, not only to the populations but to science. This is a different thing from the endowment of scientific research, as understood at South Kensington and elsewhere—it is not so much State assistance to science as its obverse, help to the State from science. The entozoic malady which is ravaging the English flocks furnishes a case in point. In the course of a recent lecture on the subject at Bedford, by Mr. Buckmaster, lamentations were made that the knowledge and skill of the farmer were being baffled by a small worm, the life history of which none of them knew. But science touches upon not the farmer's only, but all our occupations; and in the United States the State naturalist is always at hand to advise in such an emergency as that which is now trying the patience of the British agriculturist to the utmost.

BOILER EXPLOSIONS.

If no attempt is made to check these disasters the destruction of life that will have to be added up at the end of the year will be something frightful. Last year there were about fifty steam-boiler explosions, by which forty persons were killed and about as many injured. The death-list from this cause during the last decennial period numbers 700, with more than double more or less seriously injured, and there is nothing to prevent the continuance and increase of this class of preventible accidents. Ministers have been urged repeatedly to institute some system of enforced inspection, which would probably reduce these casualties to a minimum, as they generally arise from wear and tear or some other cause equally evident and equally remediable; but without effect. It is a very serious thing that any man may fill a building with improperly constructed or worn-out boilers in the neighbourhood of a crowded thoroughfare, with no law to prevent him, or to punish him after he has blown up a score or two of his workmen or neighbours; and it is a significant commentary on all this that the boiler at the Glasgow Ironworks, which collapsed on Friday last and killed about thirty people, three of them on the spot, was neither insured nor subjected to periodical inspection.

THE WYNAAD GOLDFIELDS AND THE CITY OF GLASGOW BANK.

This auriferous district in the province of Mysore, which has been known and worked, although in a very imperfect manner, from an early period, has now been carefully surveyed and reported upon by Mr. Brough Smyth, who gives a highly satisfactory account of the prospects of gold-mining in it. The Wynaad district lies on the slopes of the Nielgherries, in the south of Mysore, and near the southern apex of the Indian peninsula. Gold-bearing rocks have been found over five hundred miles of the district, as well as abundant traces of ancient native workings. One sample of the auriferous quartz of the district yielded upwards of 204 oz. to the ton, but the average was only about an ounce. Still the signs of gold are widely spread, there is abundance of timber at hand, and an ample supply of running water, and the deposit has never been attacked on anything like a systematic or scientific plan. Mr. Brough is of opinion, from what he has seen, that sooner or later gold-mining will be established as an important industry in Southern India, and the Indian Government has announced its intention not in the meantime to levy any royalty or tax upon the miners that may be attracted to Wynaad. It is interesting to know that Messrs. Smith, Fleming and Co. hold very large tracts of this gold-bearing district, and a company has now been formed to work it, under the auspices of the liquidators of the City of Glasgow Bank, and under conditions which include the division of 30 per cent. of the profits to the unfortunate contributors to the bank or their representatives, after four millions sterling have been divided between the shareholders and vendors. Here, then, is a ray of hope for the unfortunate contributors, even if they get nothing harder or heavier.

THE METROPOLIS WATERWORKS PURCHASE BILL.

Scarcely any measure was ever brought into Parliament which met with such unanimous reprobation as this has; and in the House of Commons on Monday Mr. Cross very energetically repudiated any intention on the part of the Government, in permitting its introduction, to do more than enable Parliament to settle the terms of purchase. There is no reason to doubt the word of the Home Secretary; but, in any case, such an amount of opposition has been stirred that there is now little danger of such an extravagant bargain as the terms of the provisional agreement amount to being forced on the citizens of London.

Some time ago we called attention to proceedings by some of the companies evidently intended to force up the value of their shares; but the proposal to purchase the works as it stands goes far beyond these puny attempts, for the sum named would amount to "forty years' purchase for a concession which at present may be challenged by new schemes, the outlay upon which, for a purer and better and constant supply" would involve an expenditure of not much more than a third. This is how the matter is well put by a committee promptly formed to oppose the measure. The water companies have worked their monopoly arrogantly and despotically, beyond their own shareholders they have scarcely a friend, and it is a matter for serious consideration whether a water supply drawn from the Thames and its tributaries can ever be a safe one for domestic purposes. The scheme for drawing a potable supply from Bala or some other Welsh lake, supplemented by the subterranean waters of the chalk, appears feasible and proper, while the present supply might continue to be used, if the existing waterworks were transferred to the public at a fair valuation, for street watering, flushing, and manufacturing purposes.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

THE INSTITUTION OF CIVIL ENGINEERS.

At a meeting on Tuesday, the 9th of March, Mr. W. H. Barlow. F.R.S., President, in the chair, the paper read was on "The Purification of Gas," by Mr. Harry Edward Jones, M. Inst. C.E. In dealing with the general subject, the author placed the purification of bisulphide of carbon in the foreground. The late Dr. Letheby, in 1860, was responsible for the introduction into an Act of Parliament of a limitation to 20 grains of this impurity per 100 cubic feet of gas. Until the year 1866, no such limitation had been put upon companies outside the metropolis, and since then it had only been imposed in important towns. Such limitations were nowhere enforced or respected. Dr. Letheby had an opinion that it was only necessary to resort to the exclusive use of lime as a purifying material; nevertheless it was unsuccessful when adopted in the works of the late Ratcliff Gas Company, an average for two years (1875-6) giving 28 grains per 100 cubic feet. In January, 1872, the Gas Referees reported the impossibility of fixing a limit. In 1877, the failure of the simple lime process led to the adoption of a different plan; the carbonic acid was carefully eliminated. Success was, however, only occasionally attained, and the condition of the gas at the outlet of each purifier in the series was in consequence carefully tested and recorded day by day. These tests would have been a formidable business but for the introduction at that time of Mr. A. Vernon-Harcourt's colour tests. It was found that though carbonic acid was never allowed to pass the first purifier of a set of three vessels worked consecutively, it was only possible to keep the sulphur low when the third purifier was receiving a considerable quantity of sulphuretted hydrogen. Further, that so soon as the first vessel was taken off for the necessary replenishing, the sulphur rose many grains, and did not fall until the replenished purifier had been put to work again as the third vessel, and its contents had received more sulphuretted hydrogen. This action was illustrated by a table and diagram, as was also the action of a series of four lime purifiers. The advantage of further carbonating the lime, on works which were closely surrounded by dwelling houses, led to the adoption of the Beckton system. As it became unmistakeable that sulphuretted hydrogen was mischievous when in excess, arrangements were made for abstracting it as it left the carbonic-acid system of purifiers, by interposing oxide of iron. This was carried out with marked improvement, and the effective life of the sulphide of lime was much prolonged. In practice, both for the relief of back-pressure, and for facility in renewing a sulphide-of-lime purifier, the carbonic-acid set of purifiers should yield the following results:—

	Crude gas.	A	B	C	D	
Sulphur	40	52	45	30	28	Grains per 100 cubic feet.
Carbonic acid	410	300	40	—	—	
Sulphuretted hydrogen	800	900	400	—	—	

In this state of things the sulphur was generally 25 per cent. below that in the crude gas. There was great advantage in exposing the material in the sulphide of lime purifiers to a current of air. Two purifiers at the Wapping Works of the Commercial Gas Company, which had become ineffective, were opened, the lime examined, stirred up and put back, and they afterwards worked for nine and eight months respectively, and did tenfold more work than previously. The prejudicial effect of cold in the reduction of sulphur in the carbonic-acid system of purifiers, and the beneficial effect of the application of heat from the exhaust steam of an engine, were then referred to. No advance had been made in the direction of purifying in closed vessels with liquid agents. Mr. G. T. Livesey has succeeded in eliminating the carbonic acid to 0·5 per cent. in volume, by the use of rough caustic ammonia-liquor. The tar should be separated from the gas immediately on leaving the hydraulic main. The author allowed the gas to leave the condensers in summer at no higher temperature than that of the atmosphere, and, in winter, than 40° Fahrenheit; in the former case the scrubbers usually reduced the gas to the temperature of 55°, an in the latter raised it to 45°. From the author's practice with water condensers he had found, in one type, that 1000 cubic feet per diem could be treated by 0·5 square foot of water. The result of condensation on the quality of the gas was then stated.

The purification of crude gas from ammonia proper was next referred to. The process was easy. The essentials were contact with extended superficies of water, or such concentrated intimacy as involved frictional resistance to the gas, and the ultimate exposure of the gas to pure water. No sooner was the lime substituted for oxide of iron in the scrubbers, than the ammonia appeared in the clean gas; this had been lessened by the addition of oxide of iron catch purifiers, and removed by a small quantity of sulphuric acid and sawdust in the last catch purifier. The cost of ammonia purification was very small, the particulars of which were stated. Sulphuretted hydrogen was easily removed by lime, oxide of iron, peroxide of manganese, and sulphate of iron. Of these purifiers lime was the best, and oxide of iron the cheapest and least offensive. Oxide of iron, sulphate of iron and manganese, converted the sulphuretted hydrogen on exposure to the air, into free sulphur, becoming oxides again, and being, as it was called, revivified.

We are asked to state that Supplemental Meetings for the reading and discussion of papers, by students of the Institution, have been appointed for the following Friday evenings:—March 12th and 19th, and April 2nd, 9th and 16th. The papers to be read on those evenings are, respectively:—"Storage Reservoirs," by W. C. Davies; "The Manufacture of Bessemer Steel Rails," by H. Allen; "The Construction of Brick and Concrete Egg-shaped Sewers," by E. Van Putten; "Small Motive Power," by H. S. H. Shaw; and "Railway Tires and Tire Fastenings," by R. Read. The chair will be taken at 7 o'clock on each evening, and, successively by Mr. Giles, M.P.; Dr. C. Wm. Siemens, F.R.S.; Mr. Rawlinson, C.B.; Dr. Pole, M.S.; and Mr. Berkley, Members of Council. The students have been reminded that the Council are prepared to award the Miller Scholarship of £40 per annum for three years, if a paper of adequate importance is received, as well as Miller prizes for other approved communications, and it has been intimated that a second series of meetings will be appointed if a sufficient number of papers are received.

INSTITUTE OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

On Tuesday night an extraordinary general meeting of the members of the Institute of Engineers and Shipbuilders in Scotland was held in the rooms of the Institution, Dalhousie Street. Mr. Robert Mansel, President, occupied the chair, and there was a large attendance of members. In the first instance, the meeting resumed consideration of Mr. John St. Vincent Day's paper read at last meeting on the nature and construction of the Tay Bridge.

Mr. Alexander Simpson said that although it was the duty of everyone to expose dishonest work, he thought they should not be too ready to give undue credit to the reports as to blemishes which had been circulated. In his opinion it was quite easy to erect the structure even on the present piers that were left standing, and in such a manner as would withstand all storms.

Mr. J. G. Fairweather, Edinburgh, did not think with the last speaker that the bridge could be made safe with the present piers. In his opinion the bridge would require to be taken down to the foundation; and, besides, the bridge should and could not be safely constructed as a single line one.

Mr. T. A. Arroll, Glasgow, did not think much weight should attach to some of the evidence that was laid before the Court of inquiryas to bad workmanship.

Mr. Day replied, and said that, while he agreed with Mr. Simpson that they should be careful as to how they apportioned blame, yet he could not shut his eyes to the fact that he had in his pockets pieces of lead which were picked out by gentlemen from Glasgow from the cold shots in certain of the columns of the bridge. And he and others had seen examples of the flange joints in the Tay Bridge where there was no meeting at all on one side, and wherein was so-called concrete, but which was nothing more than sand from the Tay, mixed up with rubbish from the contractor's yard and some slight cementing material; and the mixture had completely run through the joints. And it must have run through when the bridge was being originally constructed He justified his criticism of Colonel Hutchinson's inspection of the bridge on behalf of the Board of Trade.

The meeting then proceeded to consider Mr. Day's paper on the proposed Forth Bridge, and which was also read at a former meeting of the Institute. Diagrams of Sir Thomas Bouch's design, and Mr. Andrew Barclay's design for bridging the Forth were exhibited, and the details were minutely examined and discussed. In the course of the conversation,

Mr. Fairweather thought they required a good deal more information about the Forth Bridge than they yet had. He thought it a great mistake that they should resort to so extreme a span as was proposed for the Forth Bridge. He considered that a much better bridge could be designed than had yet been seen, and that by a reduced span. But he did not see why they should attempt to cross the Forth at Queensferry. He did not consider the shortest route was always necessarily the best one, for in that case there was no need for the Forth Bridge. The shortest route was across the ferry, and on to Aberdeen. But if they must have a bridge across the Forth it should be carried over at Alloa, and the cost would not be more than £50,000 or £60,000. Then he would run across the country to the Tay, which he thought should be crossed at Newburgh, where it could be done by a very small span, and that at a height which would not interfere with the navigation.

Mr. Ralph Moore suggested the tunnelling of the Forth, which, he said, might be done at Alloa, Bowness, or at St. David's. He did not think there was any practical difficulty, as at present the minerals were being wrought at Bowness at a depth of 150 feet below high water.

Mr. W. Smith remarked that it was needless to talk of new schemes, as the Forth and Tay Bridges had been resolved upon, and would be carried out. He would have liked had they had details of Sir Thomas Bouch's designs for the Tay and Forth Bridges, and he could not understand why so many difficulties seemed to be interposed to their production.

After some further conversation the meeting separated,

The Society of Engineers.—At the last monthly ballot for new members the following gentlemen were duly elected, viz., as members:—Alfred Edgar, 6, Westminster Chambers, S.W.; E. E. Glaskin, 52, Queen Victoria Street, E.C.; W. C. Pellatt, 21, Red Lion Street, Clerkenwell; and R. P. Williams, 38, Parliament Street, S.W. As Associates.—J. Caldicott, 17B, Great George Street, S.W.; M. Mildred, Gas Works, Hastings; W. F. Poulton, 9, Laburnan Street, Kingsland Road, N.; and H. Walker, 167, Tufnell Park Road, N.

Institution of Naval Architects.—The forthcoming annual meetings of the Institution of Naval Architects, which take place on the 17th, 18th and 19th of this month, in the hall of the Society of Arts, will be of unusual interest. The whole of the morning sitting on the 17th will probably be devoted to the reading and discussion of a paper by Mr. Martell, the chief surveyor to Lloyd's, on Mr. Plimsoll's pet subject, "Causes of Unseaworthiness in Merchant Steamers." Among other papers Mr. Scott-Russell will read one "On a Wave-Line Form of Midship Section." The object of this paper will be to show the applicability of his wave theory to the cross sections of ships, it having hitherto been applied to the horizontal section only. Mr. Russell will also read a paper "On the True Nature of the Resistance of Armour to Shot," Mr. William Denny "On Steel for Mercantile Shipbuilding," and Mr. M'Farlane Gray "On the Simplification of the Thermo-Dynamics of Steam." Mr. Gray's object in this paper will be to substitute rational methods for the empirical formulæ hitherto in use. Mr. J. F. Flannery will speak "On the Artificial Combustion of Anthracite Coal," as shown in some recent experiments carried out by the author and Messrs. Penn and Sons on the steamship *Elephant*. The steam trials of H.M.S. *Iris* and the resistance of screw propellers will be treated by Mr. J. A. Normand, of Havre. Lord Hampton, who has been for twenty-one successive years President of the Institution, resigns, and will be succeeded by the Earl of Ravensworth, who was well known, as Lord Eslington, in the House of Commons for the part which he took in shipping legislation. The annual dinner will take place on the evening of March 17th, when the President will occupy the chair.

Liverpool Engineering Society.—The usual fortnightly meeting of this society was held on Wednesday, the 10th inst., at the Royal Institution, Colquitt Street, Mr. A. Ross, President, in the chair. Mr. E. M. Touzeau, Survey Member of the Sanitary Institution of Great Britain, read a paper entitled "Subsoil Waters and their Drainage." The author, having briefly alluded to the effect of subsoil drainage upon the volume and flow of rivers, and the various works in which a knowledge of its principles are required, proceeded to consider the subject in its relation to health and comfort of town populations. The necessity was urged of subsoil drainage being undertaken as part of every sewage scheme; and, further, its extension to such places as are at present sewered without attention having been given to the drainage of the soil. The largely increased discharge of sewers, owing to subsoil water, was alluded to; and the advisability of relieving them of this duty was urged. In its effect upon town populations, the increased temperature of the ground, especially to the poor, and the improvement in ground air from the removal of polluted water, was pointed out. If work of this description were more generally carried out, it was remarked that much of the water now flowing off the surface into the sewers might be carried off by the land drains to the easement of the sewers. Attention was then directed to the causes of wetness in land, and the various ways by which the water might be removed; also the necessity for regulating the depths and spacing of the drains apart according to the pervious or non-pervious nature of the ground in which the drains were laid. Cases were mentioned where from want of attention to the direction of flow in subsoil waters, the pipes intercepted but little of the water which, in cases of this kind, flowed between the pipes instead of into them. From instances such as these of want of attention, it was requisite that the requirements of each district, or portion of a district, should be studied before works for the drainage of the subsoil were carried out.

Communications on the Thames.—A meeting of the Association of Foremen Engineers and Draughtsmen was held on Saturday evening at the Cannon Street Hotel, when a paper was read by Mr. W. May on "The Best Means of Communication between the two banks of the Thames below London Bridge." The meeting was called for 1 p.m., and after an hour had been occupied in preliminary business, Mr. May proceeded with his paper, in which he observed that as regarded the question of what they should do with London Bridge so as to make it meet the increased and increasing traffic, he should say that it would be well to let London Bridge alone. What were the causes of the existing evil calling for a remedy? London Bridge, besides the direct and peculiar traffic, had to meet the requirements of the immense mercantile and manufacturing traffic of the East of London. If, instead of turning to the East they looked to the West, it would be found that there were some twelve bridges, many of which had been made free by the Metropolitan Board of Works. There ought to be ready communication between some of the busiest parts of the metropolis. Taking the traffic over London Bridge, it would be found that not only was there a great traffic, over London Bridge from the East of London, but the further East the greater was the proportion of the traffic. The East end of London had a great number of manufactories, and these were increasing, while on the opposite side of the river there were many parts of land isolated, which if they were occupied, great advantages would be offered to employers and employed. He would suggest the crossing of the river by a steam ferry, which might be established between different points of the opposite shores, at a cost of £25,000 annually. He thought they might come to the conclusion that the steam ferry was the best, cheapest, and most efficient mode of transit. He trusted that, the coming summer, there might be provided a means of crossing the river which would be advantageous to the East-end, by means of a particular class of boat which he proposed to provide, in which it was desired to provide comfortable saloon accommodation as well as for the general passenger traffic. The lecturer adverted to the details of the plan, and anticipated that when the project was carried into effect it would be a great boon to the East-end of London, and would relieve London Bridge of its present enormous traffic.

Building Exhibition.—An exhibition intended to draw public attention to recent important improvements in building and furnishing appliances is to be held at the Agricultural Hall from the 12th to the 17th April next. The exhibits will be classed in five sections—Architecture, Construction, Engineering, Decoration and Furniture. Exhibits will be received between the 5th and 8th of April inclusive.

Testimonial to Mr. George Grove.—A movement is on foot for a presentation to Mr. George Grove on the occasion of his retirement from the Board of the Crystal Palace Company. The list of supporters of the scheme of itself testifies to the wide extent of Mr. Grove's labours, and includes the names of gentlemen distinguished in almost every branch of science, art and literature.

Exhibition at Graz, in Styria.—An exhibition will be opened at Graz, in Styria, next September, illustrative of the culture of land and forests, mining and metallurgy, industry and trades, art and industries connected therewith, science and public instruction. Applications for space must be made before the 30th April. All inquiries and communications should be directed to the General Committee of the Provincial Exhibition at Graz.

The Technical College.—Lord Selborne and Mr. F. J. Bramwell, chairmen respectively of the Council and Executive Committee of the City and Guilds of London Institute, have addressed a letter to the Prince of Wales, as President of the Commissioners for the 1851 Exhibition, proposing to build a college for advanced technical education at a cost of £50,000 and upwards, at South Kensington, and to maintain the same at an annual charge of at least £5000 per annum above the amount of the fees received. It is stated that the Executive Committee of the 1851 Commissioners recommend the acceptance of these proposals.

The Melbourne International Exhibition of 1880.—The whole of the allotments of space to British exhibitors have now been forwarded to the respective applicants, with the exception of those for agricultural implements and machinery. The applications in this class would, if granted, occupy an area so large that it would be impossible to find room for them in the exhibition building, and a telegram has been sent to Melbourne asking whether the commissioners there would provide the necessary additional space. Pending a reply, no decision can be arrived at by the London committee. The Government of the United States propose, at their own cost, to erect a separate annex for their exhibition of agricultural implements and machinery.

British Fine Art Ware.—On Wednesday night Sir Philip Cunliffe Owen, C.B., K.C.M.G., presided at a meeting in the theatre of the Society of Arts, when Mr. John Sparkes, head master of the National Art Training School, South Kensington, delivered a lecture on "The Recent Advance in the Production of Lambeth Art Pottery." The theatre was decorated with the fine-art work of the pottery. Mr. Sparkes gave the history of Lambeth Pottery from the middle of the 17th century, and described the manufacture of the new pottery in 1874. The lecturer then described in detail various articles before him, and pointed to the advances made in this decorative art work. He referred particularly to the new buildings on the Albert Embankment, which were entirely built and decorated with bricks, terra-cotta, and stoneware. Many of our architects had seen the suitability of this fine material for decoration, but to the generality of them it was still a neglected field. In all the separate links of this manufacture the individuality of the artist was carefully preserved, and there were, in consequence, as many ideas as there were designers to embody them. In this way the interest and character of the ware were kept up. He also called attention to the production of pictures in stoneware. Upon the conclusion of the paper the chairman commented upon the triumph of the new Doulton ware at home and abroad, and said a great debt was owing to Mr. Sparkes and to the teachers at the Lambeth School of Art. Several other gentlemen spoke.

Technical Education.—On Tuesday last a meeting of gentlemen interested in the above object took place at the residence of Mr. Morley, M.P., in Upper Brook Street, Grosvenor Square. The hon. gentleman, in opening the proceedings, after referring to a similar meeting held twelve months ago, said the conviction was growing that if England was to maintain her supremacy—if we really were, as a manufacturing people, to compete with Continental competitors—we must do something to train our apprentices, to communicate to the labouring classes some kind of intellectual culture that would help them. He had no doubt whatever that it would be skilled labour that would carry the day. So far as his own manufacture was concerned—it was very large—he did not think they had much scope for the kind of training he referred to; but he had come into contact with many persons who had arrived at such a deep impression of the need of our doing something to supplement the old apprenticeship that had all but disappeared from us, that he felt a pleasure in promoting a kind of conversation on the subject. Under the old system of apprenticeship a youth, by the time he was twenty-one, had arrived at something like a real practical knowledge of his business; but he feared that an apprentice of the present day was placed in a greatly inferior position to compete with the labour market of the world. A great number of labourers were unemployed, and he feared that the number was likely to increase rather than diminish unless they did something to deal with it. He had read with great delight the report of the executive committee of certain of the Livery Companies of London, who were maturing a plan to deal with the subject, which showed that they were really alive to some of the practical points of the question, at least in the way of preparing teachers to teach the apprentices, or those who might come to their classes, and in a spirit of liberality which he thought was full of promise for the future.—Mr. Hodgson Pratt referred to the trade schools on the Continent, and urged the necessity of combining the practical instruction of the workshop with theoretical instruction.—Professor Silvanus Thompson, Professor Leoni Levi, Mr. Mellis, Mr. Jackson, and Mr. Berry (of the Artizans' Institute), Messrs. Crace, Lucraft, Harding, Beck, Watney, Wotherstone, Doulton, and other gentlemen afterwards addressed the meeting, which closed with the passing of a resolution to form a committee to consider and report whether any steps can be taken to provide the technical and practical training of apprentices, and to consider how far that object can be included in the scheme of the City Guilds Institute, with the view of making suggestions to that committtee for the purpose.

The Ecclesiastical Art Exhibition.—Mr. John P. Seddon presided, on Saturday, in the St. James's Hall, at a dinner given in connection with the above-named Exhibition, which will, it is announced, be opened by the 1st June next. The company, who consisted of gentlemen connected with literature, science, and art, were informed by the hon. secretary, Mr. John Bray, that the building, for the erection of which funds had been already fully subscribed, would occupy a site on the Victoria Embankment, not far from the Cleopatra Needle, with approaches from the Strand and Savoy. The designs of the intended building, which is to be mainly constructed of iron and glass, and which were much admired, have been furnished by Mr. Seddon, who is one of the vice-presidents. According to these designs the building will comprise a central hall 180 feet long by 50 feet wide, and about 50 feet high, with annexes on either side, whilst towards the embankment there will be a range of saloons and refreshment rooms commanding extensive views of the river on either hand. It will, according to announcement, be specially arranged to accommodate stained and painted glass in windows of appropriate character, which can be modified according to the taste of the various exhibitors in the department of ecclesiastical art. To a great organ a prominent place will be appropriated, with the music chamber in its immediate proximity. The Exhibition, which will be international in character, since it will be open to foreign as well as British artists and art manufacturers, is to consist chiefly of pictures for churches, including oil paintings, water colours and drawings of various schools, cartoons for wall paintings, mosaics, architectural drawings, stained glass, and cartoons for stained glass, sculpture, illuminations, wood and ivory carving, bells, embroidery, tapestry and textile fabrics, missals, heraldry and sacred symbolism, music and musical instruments, sacred books and vessels, metal work, tiles, frescoes and mural decorations, and last, but by no means least, models of churches, ancient and modern. Already over 400 persons at home and abroad have signified their intention of becoming exhibitors, and there is good ground for hope that the great interest taken in the movement by the outside public generally, and by the whole of the religious community, will ensure a highly satisfactory result. The building will, it is confidently stated, be ready by the middle of May for the reception of exhibits, which will be arranged in three classes—the first division to contain the loan collection of mediæval and modern ecclesiastical art; the second, a collection of paintings, drawings, and engravings exhibited by architects and artists; and the third to be open to all ecclesiastical art firms who take spaces and conduct their own business, and to meet the requirements of this last-named division the whole of the ground-floor will be devoted to it.

MEETINGS FOR THE WEEK.

MONDAY, March 15.

Royal School of Mines.—8 p.m. Professor Huxley, on Dogs and their Forefathers.

Royal Asiatic Society.—4 p.m. Captain Durant, on Antiquities Discovered by him in the Island of Bahrein (Persian Gulf), with notes by Sir H. C. Rawlinson.

Institution of Surveyors.—8 p.m. Adjourned Discussion on Mr. W. L. Huskisson's paper on the Present Depression in English Agriculture; its real and assumed causes.

Victoria Institute.—8 p.m. Professor Hughes, on the Evidence of later Movements of Elevation and Depression in the British Isles.

Royal United Service Institution.—8.30 p.m. Major A. S. Wynne, on Heliography and Army Signalling generally.

South Kensington Museum.—8 p.m. Professor G. Barff, on Colour and Pigments in Relation to Painting.

TUESDAY, March 16.

Royal Institution.—3 p.m. Professor Schäfer, on the Physiology of Muscle.

National Life Boat Institution.—3 p.m. Annual Meeting. Address by the Duke of Northumberland, President.

Institution of Civil Engineers.—8 p.m. Discussion on Mr. Jones's paper on the Purification of Gas.

Statistical Society.—7.45 p.m. 1. Surgeon-General T. Graham Balfour, on the Vital Statistics of Cavalry Horses. 2. Professor Leone Levi, A Survey of Crimes and Offences in England and Wales from 1857-1878.

Society of Arts.—8 p.m. Foreign and Colonial Section. Capt. C. E. Foot, R.N., on Transport and Trading Centres for Eastern Equatorial Africa.

South Kensington Museum.—8 p.m. Professor G. Barff, on Colour and Pigments in Relation to Painting.

WEDNESDAY, March 17.

British Archæological Association.—8 p.m.

Institution of Naval Architects.—Noon. Annual Meeting. Address by Lord Hampton, G.C.B., the President. Annual Report of the Council. Reading and discussion of papers.

Society of Arts.—8 p.m. Mr. W. Herbert Singer, on the Art of the Silversmith.

Society of Public Analysts.—8 p.m.

South Kensington Museum.—8 p.m. Professor G. Barff, on Colour and Pigments in Relation to Painting.

THURSDAY, March 18.

Royal Institution.—3 p.m. Professor Dewar, F.R.S., on Recent Chemical Progress.

Numismatic Society.—7 p.m.

Royal Society.—8.30 p.m.

Society of Antiquaries.—8.30 p.m.

Chemical Society.—8 p.m. Professor Tidy, on River Water.

Institution of Naval Architects.—Meetings at Noon and at 7 p.m. for the reading and discussion of papers.

Civil and Mechanical Engineers' Society.—7 p.m. Mr. B. Haughton, on a Railway to India.

South Kensington Museum.—8 p.m. Professor G. Barff, on Colour and Pigments in Relation to Painting.

FRIDAY, March 19.

Institution of Naval Architects.—Annual Meeting. Lord Hampton in the chair. Noon and 7 p.m.

Royal United Service Institution.—3 p.m. Rear-Admiral .C Murray Anesley, on the Preservation of Boilers.

City of London College.—6 p.m. Dr. Heinemann, on Political Economy. Revenue of the State, its Sources, National Loans, Taxation, Canons of Adam Smith and Mill, Classification of Taxes.

Bankers' Institute.—6 p.m. Mr. H. D. Jencken, on Some Points of Difference between the English System of Law and that prevailing on the Continent regarding Negotiable Securities, viz., Bonds, Shares, Coupons, &c.

Royal Institution.—9 p.m. Professor Tyndall. Goethe's Farbenlehre (Theory of Colours).

Association of Municipal and Sanitary Engineers and Surveyors.—11.30 a.m. District Meeting (Dewsbury). Mr. B. C. Cross, C.E., on the Sanitary Condition of Dewsbury, and its Sewerage Works.

SATURDAY, March 20.

Royal Institution.—3 p.m. Mr. George Saintsbury, on Dryden and his Period.

METALLURGY AND MINING.

Destructive Boiler Explosion at the Glasgow Ironworks.—On Friday night last a lamentable explosion occurred at Glasgow Ironworks, in the northern district of the city. There were fourteen puddling furnaces in operation within the works, and an upright boiler placed between each two furnaces. No fewer than seventy persons were employed at the puddling furnaces, and these men are the principal sufferers. Shortly after seven o'clock one of the upright boilers exploded with such force that portions of it were thrown about 80 yards, and the iron roof which covered it was also shattered. All the boilers were under one massive iron roof, covered with slates and supported by strong pillars. The boilers, which were 45 feet in height, passed through the roof, and on either side was a tall chimney passing upward from each of the furnaces. The two furnaces adjoining the exploded boiler were smashed to atoms, and pieces of machinery were twisted and torn into ribands. Between twenty and thirty men and boys have been killed by the explosion, and between thirty and forty seriously injured.

The Blantyre Explosion.—The report of Messrs. William Alexander and Ralph Moore, the Inspectors of Mines, appointed to inquire into the circumstances of the Blantyre explosion, has just been issued. The following are the conclusions at which they have arrived, viz.:—(1) That the arrangements for the ventilation of the pit were sufficient, and that the quantity of air sent in was ample under ordinary conditions; (2) that the explosion was an explosion of firedamp; (3) that owing to some abnormal condition there had been at the time of the explosion an accumulation of firedamp of comparatively small extent; (4) that while locked safety lamps were handed out to the men, some of them had keys, tobacco-pipes, and matches, and some of them had been smoking at the moment of the explosion; (6) that the gas was not ignited at a shot; (6) that up to the time of the explosion five shots had been fired, and in particular one or two of them near the place where probably the gas existed, and that some of these shots may have had the effect of displacing the gas and bringing it in contact with an open light, which there is too much reason to suppose existed.

The Steel Trade of the World.—The total capacity of the steel mills at the present time throughout the world is estimated at about 3,000,000 tons for the year's production. In the United Kingdom there are 120 Bessemer converters built, of which over 80 are at work, and the annual yield from these is considered as from 755,000 to 800,000 tons. The American make is estimated at 750,000 tons, the next largest producer being Germany, which is considered by many to be capable of the greatest expansion among all the steel-making countries. Less than two years ago there were 25 converters in Prussia working out of the 50 built, and turning out 375,000 tons; which were increased by the works in Saxony and the Palatinate to 400,000; and since the revival in trade fresh converters have been put into operation. The estimate of the French steel manufacture is about 275,000 tons; that of Belgium, 150,000; of Austria, with 32 converters, 250,000; and of Sweden and Russia, 150,000. Of the Bessemer converters in England, the largest are two 10-ton ones at Sir John Brown and Co.'s works in Sheffield, the others varying between three and eight tons in capacity; and out of the 24 British steel works 17 only have rail mills. Looking at the probable extension of railways for the next twelve months, it is difficult to see how all this large output of steel rails is to be utilised.

The Genesis of Gold.—At the recent meeting at New York of the American Institute of Mining Engineers, Mr. G. W. Maynard exhibited some curious specimens of gold, obtained from a placer at Gold Run, Placer County, California, and Profs. Silliman, Hunt and Egleston all agreed in stating that the specimens shown shed more light upon the subject of the genesis of gold than any which had come to the notice of the scientific world until now. Dr. Hunt explained at some length the process of silification going on continuously in gravel deposits, while the consideration of the specimens led Prof. Egleston to the expression of his views on the genesis of gold nuggets. He pointed out that quite recently it had become known to the scientific world that sea water contained minute traces of gold, and that alkaline solutions are capable of dissolving more or less gold, so that much was probably due to percolating waters containing alkali in solution. Dr. Egleston took this opportunity to request members to aid him in a series of investigations, entered into by him some time since, to examine the nature of rusty gold, by favouring him with any material which might come into their possession. Dr. Kerr, State geologist of North Carolina, in support of the theory of the aqueous origin of gold deposits, stated that many Southern gold mines were worked over repeatedly, having become more valuable after a period of rest, so that certain deposits had afforded a number of profitable "crops" at intervals of ten or more years.

The Cost of Colliery Accidents.—The seventh annual meeting of the members of the Lancashire and Cheshire Miners' Permanent Relief Society was held in the Council Chamber, Wigan, on Saturday afternoon. The Hon and Rev. Canon Bridgeman, rector of Wigan and president of the Society, occupied the chair, and there was a large attendance of colliery proprietors and representatives from the various local agencies. The report, dealing with last year's working of the Society, and reviewing its operations for the past seven years, was presented by the Board of Management. It is stated that on December 31st, 1878, the Society had enrolled 27,281 members; at the close of 1879 the members numbered 31,846, showing an increase of 4565. The ordinary revenue of the Society has produced £25,697 18s. 2d; and the expenditure has amounted to £22,934 10s. 1d. The available balance at the close of the year was £19,294; on December 31st, 1878, it was £14,750. During the year the sum of £1500 has been invested in the debenture stock of the Corporation of the Borough of Wigan. During 1879, there were 6474 cases of disablement amongst the members, and 80 fatal accidents, by which 80 members were killed. These fatal accidents placed on the funds 46 widows and 96 children, and at the close of the year 191 widows and 466 children were receiving annuities from the Society. Of the 6474 cases of disablement there were 2680 of which only one week's relief was paid. During the past seven years the society has dealt with 26,288 cases of disablement, and with 426 fatal accidents, and has provided for 255 widows and 549 children. The amount raised from ordinary members' contributions has been £93,279; from proprietors' percentage, £9872; and from honorary members' subscriptions £953. There has been paid for funeral allowances, £4446; to widows, £7769; to children, £9325; to disabled members, £37,592; and to surgeons, £18,576. Canon Bridgeman moved the adoption of the report, and expressed his gratification at the continued progress of the society, which had been greater last year than in any year since its formation, notwithstanding the increased contributions required from the masters and men. Mr. C. G. Jackson, chairman of the board of management, seconded the adoption. The report was adopted unanimously. Canon Bridgeman was re-elected president; Mr. A. Hewlett, Wigan Coal and Iron Company, and Mr. W. Pickard, miners' agent, were re-appointed vice-presidents, and the retiring members of the board chosen. The special resolutions increasing the board of management, and directing disputed cases to be settled by arbitration instead of by the borough bench of magistrates, were approved. The accounts showed that during the past twelve months £2274 had been paid to widows of members, £2814 to children, £9741 to members on account of partial disablement from work, and £856 for funeral expenses for members having no dependent relatives. The surgeons, for attendance on members, received during the year £4029. The receipts from the men for contributions amounted to £22,864, and the colliery proprietors and honorary members subscribed £2942. At the close of the year the local agencies numbered 85.

SANITARY ENGINEERING, GAS AND WATER.

THE PHARE GAS LANTERN AND BURNER.—This consists of a lantern specially designed to contain a circle of six gas jets, which, with the arrangement for supplying the necessary quantity of air, form a burner of considerable power. Under the ring of six jets, using about 40 cubic feet of gas per hour, are two annular cylinders of glass, curved so as to cause the air drawn up by the heat of the burner above to impinge on the flames, and obtain approximately the same effect as with an argand burner, but without the drawback of a chimney. In the centre of the ring a single six-foot burner is fitted, which is not used when a large amount of light is required; but is lighted automatically by simply turning over a lever at the same time as the circle of jets are extinguished. This lantern and burner, although new in this country, have been used for some time for the purpose of the improved street lighting of the principal towns in France. In Paris several streets are lighted, notably the Rue du 4 Septembre, in which the gas illumination is in competition with the electric light of the Avenue de l'Opera. As regards economy, the electric light would be the cheapest if it could be turned down so as to reduce the illumination after midnight. This is effected with the Phare burner by a man going round and changing the burners in the manner above described at the same time as the electric lighting of the adjoining street ceases and the ordinary gas lamps are lighted. A Phare lantern and burner has been at work some time on the refuge facing the Mansion House Station, and has given satisfaction, and a lantern is about to be fixed on London Bridge. This system of lighting has been introduced into this country by Mr. Killingworth Hedges, but is the invention of an engineer in the employ of the Paris gas company.

THE GOVERNMENT WATER BILL.—At the meeting of the St. James's Vestry, Westminster, last week, Mr. Bradshaw proposed the reference of this measure to a committee for consideration and report. Mr. Beal, in seconding the motion, said he hoped all the vestries would prepare a powerful opposition. He explained that by the Bill more than £22,000,000 was to be paid for £12,000,000 of capital, and that for twelve years a bonus was to be added, which would be more than £9,000,000, making a total of over £31,000,000. This would absorb at 3½ per cent. over £1,100,000 per annum, besides interest on expenditure on new works and enlargement of the present works, while the present income was only able to pay interest on the £22,000,000, with a bare surplus. The bonus would absorb all increased income even if the present growth of revenue was maintained. He referred to the patronage to be created as well as to the continuous interference of the Government proposed by the Bill, and contended that a new Board was unnecessary. The interests of the ratepayers had been absolutely ignored. The resolution was unanimously adopted.—Since the announcement of the impending dissolution of Parliament a meeting of the London Waterworks Purchase Bill Committee has been held, Mr. James Beal in the chair, to further consider the Government Bill. The meeting, which was composed of influential ratepayers, discussed the question for three hours. The following resolutions were unanimously agreed to:—(1) "That it is eminently desirable that the Water Bill should not be withdrawn, but that every opportunity should be afforded the ratepayers to come to terms with the companies during this year in Parliament." (2) "That after the representation made by Mr. Cross, in reply to Sir C. W. Dilke, further opposition to the Metropolitan Waterworks Purchase Bill be suspended by this committee; that Mr. Samuel Morley, M.P., be requested to ask the Home Secretary to take the second reading of the Bill before the dissolution, and to include the Bill among those to be renewed in the next Parliament." (3) "That Sir Charles Dilke be requested to press for his return, which was to have been moved for on Monday, as essential to the due consideration of the financial aspects of the Bill when under the consideration of the Parliamentary Committee."

CONTRACTS FOR INDIA AND AFGHANISTAN. — The Patent Shaft and Axletree Company, Wednesbury, are engaged on contracts for Afghanistan and the Indian frontier, which, it is computed, will employ 1000 workpeople for six months. The contracts are chiefly for bridge iron.

RAILWAYS & TRAMWAYS.

CONTINUOUS BRAKES.

THE returns for the last half of 1879, made pursuant to the Act of 1878, have just been issued in a Blue Book of eighty pages, which may be had for 10d. All the details and particulars of failure or of improper action are given in tabular form. Eight brakes "appear to comply" with the conditions specified in the circular of the Board of Trade of August, 1877. They are Barker's automatic, in use on the Great Eastern Railway; Eame's, in use on the Lancashire and Yorkshire; Fay, Newell and Eame's combined, in use on the Lancashire and Yorkshire; Sander's and Bolitho's automatic vacuum, in use on the Great Western and the Midland; the last-named as modified by the Midland Railway Company; Smith's automatic vacuum, used on the Great Northern and the London and South-Western; Steel McInnes', used on the Caledonian; and the Westinghouse automatic, used on the Great Eastern, Great Northern, Lancashire and Yorkshire, London and South-Western, London, Brighton and South Coast, London, Chatham and Dover, Midland, North-Eastern, West Lancashire, Caledonian, Glasgow and South-Western and North British. There are 17 other brakes which "comply only in part" with the conditions named. In all there were, at the end of the year, 1114 engines, or 23 per cent. of the whole number, and 11,302 carriages, &c., or 28 per cent. of the whole number, returned as fitted with continuous brakes, of which 213 engines and 1532 carriages were so fitted during the last half year, leaving 3719 engines and 29,349 carriages not so fitted. The brakes that "comply" are applied by guard and engine-driver, and are self-acting. Those that do not comply are applied by guard only, or by driver only, or are sectional, or are not self-acting.

THE MERSEY TUNNEL SCHEME.—Considerable progress has been made with the borings for the tunnel to be constructed by the Mersey Railway Company under the bed of the river Mersey. During the past two months the shaft on the Birkenhead side, situate near Shore-side, Woodside, has been sunk to a depth of about 120 feet, and so far the results have been very satisfactory. The boring is through the red sandstone. On the Liverpool side the boring has been carried down to a depth of about 100 feet, partly through "made" ground, but the red sandstone has now been reached.

RAILWAY EXTENSION IN CEYLON.—On Saturday last, an influential deputation waited on Sir Hicks Beach, and urged a further extension of railway communication in the island, forty-seven miles having been already conceded. The application was for an additional twenty-four miles, without which, it is said, the portion already permitted to be made will have little value, and it is said to be supported by the Governor and the leading men of the colony. Sir Hicks Beach, however, declined to give his consent, on the ground that he objected to saddle the colony with too haavy a debt. The supporters of the project allege that the colonial debt is very light, and that the extension they ask is necessary for the full development of the coffee estates.

THE PROJECTED RAILWAY BRIDGE OVER THE FORTH.—A large and artistic view of this remarkable design has just been published by Messrs. Philips and Son, Fleet Street. It is in chromo-lithography, and does infinite credit to the lithographer. The view is taken from the large elevation and working plan of the engineer, Sir Thomas Bouch, adapted to the actual position the bridge is intended to occupy in the landscape. The total length of this bridge is to be a mile and a half; the length of two of the spans is 1600 feet, or about one-third of a mile each; its height above water 150 feet; and the height of the towers 600 feet. Thus the largest spans of the proposed bridge are nearly four times as great as the Britannia Bridge across the Menai Straits, and the general features of the proposed structure differ no less widely. The span of the Britannia Bridge is the widest span of any existing railway bridge in this country, and the bridge itself is practically a solid wrought-iron rectangular tube, whilst this proposed bridge over the Forth is more like a huge spider's web, the system adopted being that of a stiffened and tied suspension bridge, every thread of which has a duty to perform in relation to the whole.

THE ST. GOTHARD TUNNEL.—The Geneva correspondent of *The Times* writes, under date March 9:—"The meeting of the galleries at the point and almost exactly at the time fixed beforehand, which has been a sensation for the outside world, and is justly regarded as a great engineering feat, had become almost a matter of life and death for the workmen engaged in the tunnel, especially for those of them who wrought at a considerable distance from either entrance. Had the length to be pierced been a hundred metres or two longer, it is hard to see how it could have been completed at all, and the St. Gothard tunnel probably marks the extreme limit of tunnel boring wish present appliances and without vertical shafts. It had been shown in the case of the Mont Cenis that the temperature of an underground passage increases in proportion to its length, but no such temperature was experienced in the making of that tunnel as that with which the workmen and engineers of the St. Gothard have had lately to contend. The heat at the furthest point of attack on the Göschenen side, 7800 metres from the entrance, reached 100 degrees Fahrenheit, and the labour in such circumstances of walling the roofs and sides has been so severe—killing were perhaps a better word—that masons for the work were procured with great difficulty. And the heat has not been the only trouble. The supply of air sent into the galleries by the compressors was barely adequate to the needs of the men and horses they contained, which is no wonder, seeing that it had to be forced a distance of five miles; the smoke from 400 lamps, and the gas engendered by perpetual explosions of dynamite, still further vitiated such atmosphere as there was, while the stench, arising from the probably necessary absence of any attempt at sanitary arrangement, was alone enough to create a pestilence. It is not surprising to learn that among men exposed for eight hours daily to such conditions as these, new forms of disease were developed, nor that the extremes of temperature—in winter sometimes as much as 50 degrees Centigrade—they were compelled to endure were a fertile cause of inflammation of the lungs and consumption. When any one falls ill inside the tunnel he is taken to a jet of air, if there be one near; if not, a hole is broken in the air conduit, and his face held over it, when he generally soon recovers. A man was found dead in the tunnel last Wednesday; and though no post-mortem examination of the body of the late M. Faire was made, it is extremely probable, seeing that he was a person of sanguine temperament and full habit, that he, too, fell a victim to heat and foul air. The workmen are nearly all Piedmontese, and, though for the most part slightly built and, in appearance, far from robust, they are said to be very industrious, sober and efficient. Many thousands of them are now at work, not alone in and about the tunnel, but on the accessory lines all the way from the Axenstrasse, on the Lake of the Four Cantons, to Bellinzona, in canton Tessin. Between Biasca and Arolo alone there are eight tunnels, in some places rising one above another, and the line, passing through them one after the other, winds upwards like a gigantic screw towards the entrance of the great tunnel.

ELECTRICITY, TELEGRAPHY

THE SOUTH AFRICAN TELEGRAPH.—The Eastern and South African Telegraph Company announce the repair of the cable recently interupted off Mozambique, thus establishing telegraphic communication direct with the Cape of Good Hope.

THE INFLUENCE OF THE ELECTRIC LIGHT UPON VEGETATION.—At a recent meeting of the Royal Society Dr. C. W. Siemens, F.R.S., gave a detailed description of some experiments upon the above subject which have been conducted during the last two months at his house at Sherwood, and exhibited specimens. The method pursued was to plant quick-growing seeds and plants, such as mustard, carrots, swedes, beans, cucumbers, and melons, in pots, and these pots were divided into four groups, one of which was kept entirely in the dark, one was exposed to the influence of the electric light only, one to the influence of daylight only, and one to daylight and electric light in succession. The electric light was applied for six hours each evening, from 5 to 11, and the plants were then left in total darkness during the remainder of the night. The general result was that the plants kept entirely in the dark soon died; those exposed to the electric light only or to daylight only throve about equally; and those exposed to both day and electric light throve far better than either, the specimens of mustard and carrots exhibited to the society showing the difference in a very remarkable way. Dr. Siemens only considers himself as yet on the threshold of the investigation, but thinks the experiments already made are sufficient to justify the following conclusions:—(1) That electric light is efficacious in producing chlorophyl in the leaves of plants, and in promoting growth. (2) That an electric centre of light equal to 1400 candles placed at a distance of two metres from growing plants appeared to be equal in effect to average daylight at this season of the year; but that more economical effects can be obtained by more powerful light centres. (3) That the carbonic acid and nitrogenous compounds generated in diminutive quantities in the electric arc produce no sensible deleterious effects upon plants enclosed in the same space. (4) That plants do not appear to require a period of rest during the twenty-four hours of the day, but make increased and vigorous progress if subjected during daytime to sunlight and during the night to electric light. (5) That the radiation of heat from powerful electric arcs can be made available to counteract the effect of night frost, and is likely to promote the setting and ripening of fruit in the open air. (6) That while under the influence of electric light plants can sustain increased stove heat without collapsing, a circumstance favourable to to forcing by electric light. (7) That the expense of electro-horticulture depends mainly upon the cost of mechanical energy, and is very moderate where natural sources of such energy, such as waterfalls, can be made available. The paper gave rise to a highly-interesting discussion, in which it was pointed out that the evidence afforded of the practical identity, as regards vegetation, of solar and electric light, besides the probability that it would be turned to immediate account by horticulturists, would afford great facilities for the scientific investigation of the influence exerted by light, as compared with other agencies, in promoting the formation of the active principles or most valuable constituents of plants, such as the quinine of the cinchona bark, the gluten of wheat and so forth. Before concluding his observations, Dr. Siemens placed a pot of budding tulips in the full brightness of an electric lamp in the meeting room, and in about forty minutes the buds had expanded into full bloom.

NAVAL ARCHITECTURE.

LAUNCHES.

ENGLISH.

Doterel.—In the presence of a large and fashionable assembly her Majesty's composite screw sloop, *Doterel*, six guns, 1124 tons, 900 horse-power, was recently launched at Chatham Dockyard. The *Doterel* is one of the first vessels in which steel has been largely used in the place of iron, it being the opinion of those in a position to judge that steel will give a vessel greater stability than iron. For fighting purposes the *Doterel* will not be a very powerful ship, as she is only armed with six guns of light calibre but in addition to these she will be provided with a ram projecting several feet from her bow. It is expected that her engines will give her a good rate of speed, being of 900 horse-power nominal. They will be fitted on board by Messrs. Maudslay and Son. She is to be completed for sea and commission during the ensuing year, although she has been less than two years in hand. The vessel was immediately docked to be completed. Her dimensions are as under:—Length between perpendiculars, 170 feet; extreme breadth, 56 feet 1 inch; depth hold, 16 feet 9½ inches.

Hartlepools.—On Feb. 26th Messrs. W. Gray and Co. launched from their yard at West Hartlepool an iron screw-steamer of the following dimensions:—Length between perpendiculars, 256 feet 6 inches; breadth, 34 feet 6 inches; depth of holds, 19 feet 9 inches and 24 feet 3 inches; gross tonnage of 1760 tons; classed 100 A 1 Lloyd's; will carry a deadweight of 2350 tons; engines, 150 horse-power, by Messrs. T. Richardson and Sons, of the Middleton Ironworks, Hartlepool; and has complete double bottom for water ballast, raised quarter-deck, long bridge, topgallant forecastle for crew, and permanent iron partition all fore and aft in centre. The vessel was christened the *Hartlepools*.

Lord Jeffrey.—On the 28th February there was launched from the Tyne Iron Shipbuilding Company's yard at Willington, a screw-steamer, built to the order of Messrs. Charles Tully and Co., Newcastle-on-Tyne, of the following dimensions:—270 feet by 35 feet by 24 feet 6 inches, classed 100 A at Lloyd's, and fitted up with all the latest improvements. The engines are 160 horse-power, and built by Messrs. R. and W. Hawthorn: fitted with one of their patent boilers, including steam starting gear and steam steering gear—the latter by Messrs. Donkin and Nichol. The vessel is under contract with the West African Steam Navigation Company, and, as soon as completed, will proceed to that station. As she left the ways she was named the *Lord Jeffrey*.

Rothesay.—On Feb. 28th, the *Rothesay*, an iron screw-steamer, was launched at Jarrow by the Palmer Shipbuilding Company, for Messrs. R. C. M'Naughtan and Co., Liverpool. The vessel measures 285 feet in length by 37 in breadth by 24½ feet depth of hold. She is constructed to carry about 3150 tons dead weight, and will be engined by a pair of Messrs. Palmer's inverted direct-acting compound surface-condensing engines, of 220 horse-power nominal. She is built with extra strength, and is specially suitable for the Atlantic and Eastern trade.

Thomas Turnbull.—On the 28th February the largest iron screw-steamer ever built at the port of Whitby was launched from the Whitehall Shipbuilding-yard. The new steamer has been built by Messrs. Thomas Turnbull and Son, and is an addition to the fleet owned by Messrs. T. Turnbull and Co. She was christened the *Thomas Turnbull*, in honour of the head of the firm. The steamer will carry 3000 tons deadweight; has engines of 180-horse power, by Blair and Co., of Stockton; has been built under special survey for the highest classification at Lloyd's; and is adapted for the Indian and Atlantic grain-carrying trade.

Yoritomo Maru.—On Feb. 28th, a screw-steamer, named the *Yoritomo Maru*, was launched at Southwark by Mr. Robert Thompson, jun. Her dimensions are:—Length over all, 217 feet; breadth extreme, 32 feet; depth of hold, 15·6 feet. The vessel, which possesses all the most modern appliances, has been built to the order of the Japanese Government.

SCOTCH.

Coreba III.—On February 23rd, a screw-steamer, built to the order of Signor Piaggio, of Geneva, was launched by the Messrs. A. M'Millan and Son, from their dockyard at Dumbarton. The *Coreba III.* is 1300 tons burthen, and her engines, which will be 120-horse power, are being put on board by Messrs. Matthew Paul and Co., engineers, Dumbarton. She is schooner rigged, is provided with all the most modern appliances, and is classed 100 A 1 at Lloyd's.

Ivanhoe.—On Feb. 25th, Messrs. D. and W. Henderson and Co. launched from their shipbuilding yard, Partick, a handsome paddle steamer named the *Ivanhoe*, of the following dimensions:—Length, 225 feet; breadth, 22 feet; and depth, 8 feet. The vessel is fitted with a pair of surface condensing diagonal oscillating engines, the cylinders being each 43 inches, and the stroke 5 feet 6 inches. She has also two haystack boilers, constructed entirely of steel, each 12 feet 9 inches diameter. The saloon, which will be very luxuriously furnished, is 190 feet long, and is on the upper deck. The smoking room is forward, and the steerage aft. The dining saloon is below; and the galley, instead of being on deck, adjoins it. The route of the new vessel is to be between Arran and Helensburgh *via* Kyles of Bute. The *Ivanhoe* will be conducted on temperance principles, and she is intended as the pioneer of a fleet of saloon temperance steamers.

Kameruka.—On February 28th, Messrs. Russell and Co. launched from their yard in Greenock a twin screw-steamer of 350 tons. As she left the ways she was named the *Kameruka*. The vessel has been built to the order of Mr. Edye Manning, of Sydney, for the Illawarra Steam Navigation Company, to replace the *Monara*, which was lost recently on the Australian coast. The *Kameruka* is built entirely of steel, and is the first vessel built of that material in Greenock. Messrs. Rankine and Blackmore, of Greenock, will supply the steamer with two pairs of direct-acting compound surface-condensing engines of 120-horse power. The vessel has accommodation for 50 first-class and 30 second-class passengers.

Kangra.—On Saturday, Messrs. A. and J. Inglis launched from their shipbuilding establishment at Pointhouse a beautifully-modelled screw-steamer, named *Kangra*, of the following dimensions:—Length, 285 feet; breadth, 35 feet; depth, 26 feet 3 inches; tonnage, 2100 tons. The *Kangra* has been built for Messrs. Gray, Dawes and Co., London, and is intended to trade between London and the Persian Gulf. Her engines will develop 1250-horse power, and she is fitted with all the latest improvements, including steam windlass, steam steering gear, &c. The new vessel has a double bottom for water ballast. The vessel is constructed throughout of steel, the frames being by the Steel Company of Scotland, and the plates by Herr Krupp.

Litoral.—On Feb. 21st, Messrs. H. M'Intyre and Co. launched from their shipbuilding yard, at Merksworth, Paisley, the *Litoral*, an iron screw-steamer of 600 tons. The *Litoral*, which is intended for passenger and cargo traffic on the River Plate, has been built to the highest class at Lloyd's. She has a full poop, which will be fitted up for the accommodation of a number of first-class passengers, the officers having their quarters under the bridge, and the crew in a spacious topgallant forecastle.

Niger.—On the 11th March, Messrs. John Elder and Co. launched from their shipbuilding establishment, Fairfield, Govan, Her Majesty's ship *Niger*, a composite paddle-wheel steam-vessel for carrying despatches. The dimensions of the new vessel are:—Length, 160 feet; breadth, 25 feet 6 inches; depth of hold, 9 feet 10 inches; draught of water, 7 feet 9 inches; displacement, 540 tons. The indicated horse-power of engines is 480, and the armament will consist of two bow and stern chasers and four broadside guns.

Onward.—On Feb. 27th, Messrs. Murdoch and Murray lauched from their yard at Greenock a screw-steamer called the *Onward*, for the Great Northern Fish Carrying Company, Hull, and of the following dimensions: Length 130 feet, breadth of beam 21 feet, depth of hold 11 feet. Messrs. Muir and Houston, Glasgow, will supply her with one pair of surface-condensing compound engines, with cylinders of 20 and 40 inches in diameter, and a 27-inch stroke. There will be a tubular boiler of 80 lb. pressure. The *Onward*, which is to be engaged in the fish-carrying trade, is the first of an order of four vessels to be build by the same firm.

Toledo.—On the 24th February there was launched from the shipbuilding yard of Messrs. Barclay, Curle and Co., at Whiteinch, a screw-steamer, named the *Toledo*, which has been built to the order of Messrs. James Currie and Co., of Leith, and is intended for the Baltic trade of the Leith, Hull, and Hamburg Steampacket Company. This steamer has been constructed entirely of steel supplied by the Steel Company of Scotland. The following are the principal dimensions of the vessel:—Length, 250 feet; breadth, 33 feet; depth, moulded, 18 feet 4 inches; tonnage, gross register, 1170 tons; engines, compound D.A., 30 inches and 52 inches cylinders, and 36 inches stroke. The vessel is classed 100 A at Lloyd's, under special survey.

Vladivostock.—On the 24th February Messrs. Lobnitz, Coulborn and Co. launched from their yard at Renfrew, the *Vladivostock*, screw-steamer of 1100 tons register and 160 horse-power nominal, of the highest class at Lloyd's and at Veritas. She is the property of Russian owners, and is intended to trade between the River Amoor and China, under the command of Captain Voronoff, of the Imperial Navy.

TRIAL TRIPS.

George Gowland.—This steamer had her trial trip on the 24th ult., leaving the Dock-head, Hartlepool, at noon. This vessel is a collier steamer, and will run between Hartlepool and London, commanded by Captain Meldrum. Her engines are by Messrs. T. Richardson and Son, Hartlepool, and have all the latest improvements; are 90 horse-power nominal, cylinders 25 inch by 48 inch, length of stroke 30 inch, and boiler pressure 70 lb. She has double bottom for water tanks. The trip lasted about three hours, the average speed of the steamer being 12 miles per hour, measured distances.

Henzada.—The screw-steamer *Henzada*, built by Messrs. A. and J. Inglis, Pointhouse, for Messrs. Gray, Dawes and Co., London, went down the river recently on her official trial trip. The speed attained was 11·76 knots per hour, and the working of the machinery was very satisfactory. Her dimensions are 285 feet by 35 feet by 26 feet 3 inches; gross tonnage, 2078 tons. She is constructed with an entire double bottom for water ballast on the bracket cellular system, and is fitted with full poop for cabin passengers. She will be employed in the trade between London, Kurrachee and the Persian Gulf.

Muriel.—On Tuesday afternoon there proceeded to sea from the shipyard of Messrs. Raylton, Dixon and Company the s.s. *Muriel*, which has been built to the order of Messrs. Rayner and Murray of this town. The *Muriel* is 250 feet long by 33 feet broad, and 17 feet 9 inches in depth of hold, is 1387 tons gross register, and will carry 1900 tons of cargo on a draft of 17 feet 6 inches. She is built on raised quarter-deck principle, and furnished with double bottom both fore and aft for water ballast, has iron masts and plate iron decks, and large hatchways, four steam winches, and every convenience for the rapid loading and discharging of cargo. The cabins for the accommodation of captain, officers and engineers, are placed amidships under the bridge, and there are two spare cabins for the accommodation of occasional passengers. The cabins are beautifully fitted with polished hard wood panels, and have an air of comfort and finish unusual in a merchant steamer. The engines are 120 horse-power, are of the highest class of make by Messrs. Thomas Richardson and Sons, of Hartlepool. The working of the ship was eminently satisfactory; a speed of 11 knots having been made at the trial trip; after which she proceeded to the docks there to load bridge material for the Afghan railways, discharging at Kurrachee.

H.M.S. *Inconstant.*—The unarmoured ship *Inconstant*, which is under orders to take out Vice-Admiral Sir Beauchamp Seymour, the new commander of the Mediterranean Fleet, Captain Lord Walter Kerr, his flag-captain, and a new crew for the *Alexandra*, made the commissioned deep-load trial on March 1st outside the Isle of Wight. The trial took the customary form of a three hours' run after repairs. The engines worked in a satisfactory manner, and the boilers generated a full supply of steam without the blast being necessary. The draught of the ship was 22 feet forward and 26 feet aft. The average steam in the boilers was 18·83 lb., the revolutions per minute 66, and the horse-power 4995·3. A mean speed of 14 knots was realised.

THE SOLENT.—The London and South-Western and Brighton and South Coast Railway Companies have purchased for £38,000 the steamer plying between Portsmouth and the Isle of Wight, the joint companies having decided to work the passage in conjunction with the Isle of Wight Railway.

WHITEHAVEN SHIPBUILDING COMPANY.—The amount of capital subscribed with a view of resuscitating the Whitehaven Shipbuilding Company now amounts to close upon £60,000. When this sum is reached the new company will be formed, and it is thought only to be a question of a few days.

TRANSPORTATION OF LARGE VESSELS OVERLAND.—M. Daubourg, a French engineer, claims to have devised a means of transporting large vessels over isthmuses, however steep, and an experiment is shortly to be made at Argenteuil by lifting a 2000-ton ship from the river and taking it on rails to another point on the river.

THE ADAPTATION OF OCEAN STEAMERS TO WAR PURPOSES.—On Friday last, at the Royal United Service Institution, the Marquis of Lansdowne presiding, Mr. Donald Currie, C.M.G., read a long paper on the above subject. Mr. Currie pointed out the immense military and naval power of Continental nations, and urged the vulnerable character of our commerce, the danger of our food supply being cut off in time of war, and the injury which might be inflicted upon our commerce by an enemy in face of the present position of our navy. He referred to the increased power of action upon the sea of Italy, France and Germany, and then drew attentioe to the Russian naval advances, especially in the North Pacific, and to the preparations made among the merchants of Russia to support their country by volunteer subscriptions to provide cruisers for the Government. No doubt these suggestions and subscriptions were made in order to impress Great Britain with a full sense of the power of Russia and to influence the British shipowners; but whateves might be the reasons there could be no doubt that this country was face to face with threatened dangers, against which provision could be made by designing our mail and trading vessels for a ready change to war purposes. He pointed out that the first effort of an enemy would be to cut off our telegraphic communication with our dependencies, and hence it behoved us to have ready mail steamers properly armed to carry on our communications. As the country paid for the mail service, it should see that the vessels selected were capable of being thus converted to the war service of the nation, and preference should be given in the Government employment to vessels which could be easily converted into defensive and offensive cruisers, despatch-boats, and gunboats. He stated that the Government at times had employed vessels in the late war in South Africa which had not been built with any view to be converted to the use of the country in time of war, and thus those who had considered the subject were not encouraged to build ships which could thus be used by the Government. As a matter of fact, no consideration had been given to the fact that certain steamers were fitted with the best engines of coal-saving character, for the steamers employed lately burnt a vast deal more coal than the others, and it would have been greatly economical if discrimination had been used in the employment of the steamers. He proceeded to state that the shipowners of the kingdom had been requested to give plans to the Government of their vessels, and though this had been done no advantage had resulted to those who had complied with the request. He entered into details showing how the vessels could be fitted ready to take an armament on board at a short notice, and such vessels could be reckoned on as a reserve. He urged that the Government should arrange to pay a subsidy to ships which were prepared to be given up at any moment to the Government service, and that one condition should be that the men employed on the ships in the merchant service should include some of the Royal Naval Reserve. He warned the Government that the information which the Government had sought with regard to the resources of the merchant service and adaptibility to war purposes was all known to foreign maritime Powers and all that had been done by the Government action was to afford much information to foreign Powers on the details of the merchant steamers, their speed and adaptability to other service so as to give a choice to any foreign Government of our steamers. In 1878 it was stated in Parliament by the First Lord of the Admiralty that it was intended to arm thirty merchant steamers as armed cruisers, but nothing had been done as yet in that direction, and the organisation was left until a war broke out. He made suggestions in detail respecting the action which might be taken to draw the Royal and merchant services together by an interchange of duties of officers. Mr. Currie dwelt upon the advantages which would result from our possessing a permanent head of a department like the Admiralty, and insisted that our statesmen would do well to give more consideration to the questions affecting the welfare of the country than, as they appeared to do, to questions of party triumphs. The discussion was taken up by Admiral King Hall, Captain Sir Spencer Robinson, Captain Colomb, R.N. and Captain Bedford Pim, M.P. Eventually it was resolved to continue the discussion on the following Thursday. The speakers gave a general support to the principles and views of Mr. Currie.

HORNSBY'S GRAVEL DISTRIBUTOR.—The want of an efficient and economical machine for distributing sand and gravel over the surfaces of the streets when rendered slippery by either frost or a slight rain has long been felt. This want, however, has now been met by Messrs. R. Hornsby and Sons (Limited), of Spittlegate Ironworks, Grantham, who have brought out a machine which is well adapted for its intended purpose. This new distributor has a rotary barrel with projections arranged spirally throughout its whole length. These projections have each a scraper to remove from them the sand, as they carry it from the hopper; but each scraper works independently, so that if any one presses too lightly on the barrel it can be set closer without necessitating an alteration of the adjustment of the remainder. The barrel is fixed on the main axle, and therefore revolves in the same direction as the travel of the road wheels, and is driven by a spring clutch to throw it in or out of gear. The rotation of the barrel being in this direction the man's seat is fixed upon the hopper in such a position that he can see and thoroughly control the action of the machine. In the hopper is a set of stirrers moving at a slow speed to and fro upon a plate, and keeping the sand in motion. These stirrers are driven by a revolving cam on the main axle, and the plate and stirrers can be quickly removed for cleaning. The sand, in falling from the barrel, drops upon a rotary distributor which spreads it evenly and equally upon the surface of the road. The chief advantages of this new machine are the evenness with which the material is distributed, simplicity of design, strength and perfection of workmanship. It will meet a long and widely felt want, and those who have had practical experience of past difficulties in making roads safe for traffic can fully appreciate the perfection now attained. The advantages of this distributor were fully demonstrated yesterday afternoon to the parochial authorities of St. George's, Hanover Square, including Mr. Livingstone the surveyor to the parish. There were also present Mr. Thomson from the society for the Prevention of Cruelty to Animals, and Mr. Eaton of the London General Omnibus Company, the presence of whom indicates the interest taken in the invention. The hopper was charged with 10 cwt. of gravel which was distributed in an even band 750 yards in length and 6 feet in width. The gravel was fed out very liberally, or a greater length might have been covered. The working of the machine was all that could be desired.

ARMS, ARMOUR AND EXPLOSIVES.

NEW MOUNTAIN GUNS.—A complete battery of six guns on a novel principle have just been completed at the Royal Gun Factories, Woolwich, and will be issued for service. They are called "mountain guns," but instead of weighing merely 200 lb., like the "mountain gun" used in Abyssinia and Zululand, they will weigh 400 lb. each. As, however, an essential condition of mountain artillery is that every part of it shall be carried on the backs of mules, these guns are made in two pieces, screwed together, and strengthened at the joint by a third piece in the shape of a ring or collar. The breech end of the gun when disjointed weighs 200 lb., and the barrel with collar amounts to about the same weight, which is regarded as a fair burden for a mule over hilly country. These guns, like their smaller namesakes, are of the small calibre adopted for 7-pounder projectiles, but their greater length and weight enable them to do much more effective work. They have been made from a design by Sir William Armstrong.

STEEL PLATES FOR AMERICAN WAR-SHIPS.—A Washington special says:—"Several members of the House Naval Committee have been considering the question of the substitution of steel for iron in the construction of armoured ships of war. Having obtained considerable information on this subject, they are desirous of getting this before the full committee, and at their next meeting the matter will be formally brought up and considered. Mr. McKay, a shipbuilder, and others from Boston and New York, will appear, and submit to the committee the results of the experiments in England and Germany, showing that the maritime Powers of Europe have abandoned the use of iron for armour plates, substituting steel, as it is found by actual test that five inches of compound steel plate will afford a resistance equal to ten inches of iron. It has been suggested to the committee that the subject had better be thoroughly examined before reporting the appropriation asked by the Secretary of the Navy for the completion of the four "ironclads" authorised by act of Congress. The Secretary of the Navy is also considering this matter, and expects shortly to forward to the committee the result of his investigations.

THE MANUFACTURE OF DYNAMITE.—The industrial production of nitro-glycerine, the base of dynamite, has been attended with no little danger, as many terrible accidents bear witness. Among the prizes recently awarded by the French Academy of Sciences is one of 2500 francs to MM. Boutmy and Foucher, who, by introducing new modes of producing nitro-glycerine in large quantity, and by various precautions, have rendered the manufacture of dynamite much safer, so that in their works at Vonges no life has been lost during the last six years, and the general health has been excellent. In the old method, in which fuming nitric acid, or a mixture of this and sulphuric acid, is made to act on glycerine, and the mass is suddenly immersed in water, the reaction often produced heat sufficient to decompose a part of the nitro-glycerine, occasioning violent explosions (in spite of the refrigerating processes adopted). The principle of the new process consists in obviating the greater part of the heat by first engaging the glycerine in a combination with sulphuric acid, forming sulphoglyceric acid, and then destroying slowly, by means of nitric acid, the sulphoglyceric compound. Two liquors are prepared in advance—a sulphoglyceric and a sulphonitric (the latter with equal weights of sulphuric and nitric acid). These disengage a considerable amount of heat; they are allowed to cool, and are then combined in such proportions that the reaction takes place slowly. In the old method, the nitro-glycerine is separated almost instantaneously, and rises in part to the surface, rendering washing difficult. In the new it forms in about twenty hours, and with a regularity which prevents danger. It also goes to the bottom of the vessel, and can be washed rapidly.

PARLIAMENTARY NOTES.

THE LIGHTING OF THE RED SEA.—In the House of Commons on Thursday last week, on going into Committee of Supply, Mr. T. Brassey called attention to the necessity for erecting additional lighthouses on the island of Galita and at various points in the Red Sea and the Gulf of Aden. Sir J. Hay, Mr. Pease and Mr. Bentinck also made some remarks on the same subject, and Lord Sandon, who pointed out that it was after all a matter of funds, assured the House that his Department had been, and would continue to be, in constant co-operation with foreign Governments for the establishment of lighthouses along the routes traversed by commerce.

THE GOVERNMENT WATER BILL.—On Monday evening, in reply to Sir Charles Dilke, who inquired what was to become of this measure, Mr. Cross said:—"The hon. baronet must know perfectly well that I stated the other night that, as far as any bargain with the water companies was concerned, it never was the intention of the Government, in any form or shape, to force any bargain upon the public. The only proposition which the Government has ever made in regard to the matter is this—that a measure should be introduced into the House and go before a committee, and if the committee or the House thought the bargain would not be a beneficial, one there would then, of course, be an end to it. There was no intention on the part of the Government to force any proposition on Parliament."

CONTINUOUS BRAKES.—On Tuesday evening, replying to Dr. Playfair, Viscount Sandon said,—I can hardly say that the steps taken by the railway companies as to continuous brakes have been as energetic and as satisfactory as I could wish, for up to the present time only 1114 out of 4833 engines, and 11,302 out of 40,651 carriages, &c., in use, have been fitted with continuous brakes. Of these, 288 engines, and 2441 carriages, or 6 per cent., were fitted during the year 1878. In 1879 the progress was not very great, though it is slightly in excess of 1878, that is to say, 352 engines and 2912 carriages, or 7 per cent., were fitted during that year. I cannot hold that these figures show any very rapid action. It is fair, however, to observe that the constant improvements which are being made in continuous brakes explain to a certain degree the hesitation of the companies in coming to a decision on this matter, and they also certainly show how inexpedient it would be that Parliament, unless absolutely compelled by the want of action on the part of the companies, should lay down a rule as to the adoption of some particular form of brake.

THE SHIPMENT OF GRAIN IN BULK.—In reply to Sir C. Russell, Mr. Egerton on Monday night said:—I understand that my hon. friend the Vice-President of the Board of Trade suggested some days ago to the hon. member for North Warwickshire, who will probably be the Chairman of the Committee, that the Committee, without waiting to decide on the whole matter, should report on the grain question as soon as it had come to a decision on the point. The hon. member for Warwickshire has, I understand, approved of that proposal. The leading points with respect to grain crrgoes on which the Government especially desire the opinion of the Committee are:—Firstly, whether insisting on the carriage in bags of all grain on shipboard would, as some very competent judges have asserted, increase instead of diminish the danger to human life on account of the faulty construction of ships which have been during the last three or four years engaged in the grain trade; secondly, if these opinions are incorrect, and if the restrictions imposed on carrying grain in bulk appear in themselves desirable, what effect they would have in enhancing the price of grain as bearing on the food supply of the population from abroad; thirdly, whether such restrictions would transfer the grain trade from British to foreign shipowners who had no restrictions. These are the leading points upon which we desire information an the grain-cargo question before we think the Government or the House would entertain any proposal for legislation on the subject; and I see no reason why after a month or six weeks the Committee could not report on these points, so that legislation could without difficulty take place on this one point before the end of the summer if it should be considered desirable.

COMPENSATION TO RAILWAY SERVANTS.—On Tuesday night Mr. Raikes called attention to the recommendations of the Royal Commissioners on Railway Accidents respecting compensation to railway servants injured in the performance of their duty. Arguing that railway servants ought to be dealt with specially, he pointed out that the railways are possessed of an enormous monopoly, and that it was a matter of public interest that railway servants should be protected as much as possible in the discharge of their duty. Grounding himself on numerous extracts from the Reports of the Railway Commission and from memorials of the railway servants, he sketched out a plan by which railway servants killed or injured from no fault of their own should receive a maximum compensation to be settled by a Board of Trade arbitrator. The maximum for death he proposed to fix at £200, and for injuries at £100 or thereabouts, and taking the deaths at 50 per annum and the injuries at 500—the rates given in the latest return—he calculated that these compensations would cost the railway companies £60,000 a year. He also proposed that there should be an insurance fund for meeting the case of accidents to which the men contributed by their own negligence. Sir E. Watkin objected altogether to singling out the railway industry for exceptional legislation, and denied that the employment was specially dangerous, quoting in support of his denial the statistics relating to violent deaths. He insisted that all employments should be dealt with on the same footing, and moved an amendment in favour of establishing some general and adequate system of insurance to which both capitalists and workmen should subscribe in equal proportions. Mr. Hall argued in favour of dealing exceptionally with railway servants, and during his speech an ineffectual attempt was made to count out the House. Very shortly after, while Mr. Davies was speaking against the motion, a second attempt was made to count out, and only thirty-five being found to be present, the House perforce adjourned.

THE NAVAL ESTIMATES.—In Committee of Supply on Tuesday night Mr. W. H. Smith made his annual statement on the Navy Estimates, which, he said, showed a slight decrease, and which, he contended, in answer to the objections urged in the preliminary discussion, were amply sufficient for all the necessities of the case. On the first vote of 58,800 men and boys, he went into some details as to the manning of the Navy—assuring the House that, by the concurrent testimony of all the officers with whom he had conversed, there was a gradual but certain improvement in the respectability and character of the British sailor. With regard to the Reserves, we had 17,000 of the First and Second Class, besides more than 5000 pensioners under the age of fifty. He also related the steps taken to regulate the sub-lieutenants' list, as a consequence of which, he said, the entry of Naval cadets would be limited to 55 annually. On the Admiralty vote he explained that the reorganisation scheme had not only effected an economy which would ultimately amount to £52,795, but had been accompanied by increased efficiency. On the shipbuilding vote, he stated that the programme of last year, both in the dockyards and in private yards, had been substantially carried out, although it had been thought right not to press on the completion of some of the most important ironclads, pending experiments with compound armours, the result of which, he added, had fully justified the delay. Experiments also had been going on in regard to the armament of our ships, and e committee had been appointed to make trial of a 43-ton breech-loader which had been designed for the largest ships of the Navy, as well as of an 8-inch and a 6-inch breech-loader for smaller ships. Explaining the programme of the coming year, he stated that it it is intended to lay down one, and, possibly, two ships, of a novel type, which might be described as a *Colossus* with two barbettes instead of two turrets, which would be armed with four of the new breech-loading 43-ton guns if they turned out to be successful, and would also carry some of the smaller breech-loaders and machine guns. The speed would be 15 knots an hour, the coal stowage 1200 tons, and the cost for hull and engines would be about £540,000. It was also proposed to lay down three unarmoured cruisers, which would have an average ocean speed of 14 knots, carrying coal enough for 4000 knots at this speed. In dealing with this portion of the Estimates Mr. Smith took the opportunity of deprecating overbuilding, pointing out the danger that in the rapid advance of improvements in guns, armour, &c., a ship might become obsolete before she was complete: and in explaining the use which it was intended to make of the mercantile marine as cruisers in the event of war, he mentioned that a new gun-carriage is under trial for the 6-inch guns, which if successful would lead to a great reduction in the number of men required to man a ship. Provision is made for torpedo boats in order that two may be alloted to each first-class ship; and summing up the general condition of the Navy, he stated, in order to relieve any alarms which may have been created, that there are ready in the dockyard, or nearly ready, nine ironclads, four corvettes, two despatch vessels, six turret ships for coast defence, 12 gunboats for river service, and 25 gunboats for harbour defence. As to repairs, he said that no ship would be repaired for which work could not be found, or which would not be of use when repaired; and with regard to his general policy, he said it would be to build the smallest ships in which could be combined protection for the vital parts, speed, handiness and coal capacity. Finally he contended that, taken all round, though these were "peace and economy" estimates they were adequate for the work to be done.—The vote for men was agreed to, as were also sums on account of the whole of the other votes, and of Classes 1 to 7 of the Civil Service.

CO-OPERATIVE STORES.—Sir Massey Lopes, chairman of the Select Committee of the House of Commons appointed to inquire into the operations of Civil Service and other co-operative stores, announced at the meeting of the committee yesterday morning that he and his colleagues were unanimously of opinion that, owing to the dissolution of Parliament, it would be futile to take any further evidence during what remained of the present session. Sir C. Russell said they could do nothing but recommend to the House that the committee, or a similar one, should be appointed by the new Parliament to take up the evidene where this committee left it. The committee adjourned *sine die*.

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THE HISTORY OF STEEL.

To the Editor of IRON.

SIR,—I see some remarks respecting Mr. Jeans' "History of Steel" in your impression of the 5th inst., and it is therein stated that the much-debated question of the value of my process, which supplied the missing link and rendered the Bessemer process a commercial success, has been by Mr. Jeans exhaustively dealt with. I have never seen Mr. Jeans, nor has he ever in any way communicated with me, nor have I seen his new work; I cannot, therefore, estimate or judge of the degree of exhaustion the much-debated question has undergone in his hands. The rule has been with writers on the subject of Bessemer steel either wholly to ignore the stubborn fact that my invention has been, and is, so far, indispensable to the manufacture of Bessemer steel, except in a few isolated instances, where spiegeleisen being alone employed in the converter, no subsequent addition of spiegel is necessary. Or else the allusion made is so slight that no one, unless conversant with the facts of the matter, would conclude that my process possessed more than a most trivial value. Mr. Jeans may, however, have been the exception which proves the rule; but how one man can treat exhaustively of another man's invention without the assistance of the inventor himself in any way, seems somewhat extraordinary.

A company has, I see, been formed for the manufacture of ferro-manganese, and the promoters affirm that whilst the steel manufacture of England and America is greatly dependent upon the use of spiegeleisen, yet ferro-manganese is preferred, where it can be obtained. Now any one would infer from this that spiegeleisen and ferro-manganese are two distinct substances, though in reality they are each alloys of iron and manganese, containing also carbon; and as nobody has yet defined where spiegeleisen ends and ferro-manganese begins, the one fact which cannot be disputed is that ferro-manganese is spiegeleisen and spiegeleisen is ferro-manganese; and the employment of either or both of them, as an addition to Bessemer metal, is my patented process. If a cup of tea contains one lump of sugar it is still tea, and tea it will remain, even if a second, third, or fourth lump of sugar be added. So, in like manner, if spiegel contains ten 10 per cent. of iron it is still spiegel, and the fact of its containing sometimes 20, 30, 40, or even 80 per cent. of iron, does not make it other than spiegeleisen, namely, an alloy of iron and manganese containing carbon. To make the world, however, believe that my process was superseded by ferro-manganese, this newfangled title was conferred upon spiegel rich in manganese.

When certain processes to which I have called attention are practically carried out, spiegel, whether rich or poor in manganese, will become unnecessary. Neither are essential to the production of steel, any more than to that of bar or malleable iron. They have been hitherto essential, because it was not known in what manner they could be dispensed with.—I am, &c., R. F. MUSHET.

Cheltenham, 6th March, 1880.

NOTICES OF BOOKS.

Easy Lessons in Heat. By C. A. MARTINEAU. London Macmillan and Co. 1880.

THIS is a very successful attempt to teach a somewhat important department of the philosophy of common things in a popular manner. It is primarily intended for the young, but as science teaching in schools is only of very recent introduction, there are numbers of their seniors who probably would acquire for the first time, by means of it, a really accurate knowledge of the causes of many familiar occurrences continually going on around them. The properties of heat, its expansion of most substances, conduction, convection, radiation, even the somewhat difficult theory of energy and the conversion of motion into heat, are put very clearly. The apparatus needed for the experiments is specified at the commencement of each chapter, and figures of the different instruments given, which are of the simplest and most readily accessible; and on the whole, either for school or home instruction, so far as it goes, it would be difficult to find a better textbook.

Easy Lessons in Light. By Mrs. W. AWDRY. London: Macmillan and Co. 1880.

LIKE its companion volume on heat, this is one of a series of "easy lessons in science," and equally deserves the title. The apparatus specified by the authoress are still simpler than those prescribed for the experiments in heat, although the subject is one even more difficult to handle, especially with a non-mathematical audience. Refraction, reflection, and the other phenomena of light are first explained and then copiously illustrated by many familiar, often ingenious examples; the undulatory theory is very clearly explained, as well as the velocity of the light waves and the means by which it is measured, easy methods of testing the different processes being suggested. The principle of the spectroscope is expounded with equal clearness.

BOOKS RECEIVED.

Experiments on the Strength of Wrought-Iron and of Chain Cables. By Commander L. A. Beardslee, U.S.A. Revised and abridged. By W. Kent, M.E. New York: J. Wiley and Sons; London: Trübner and Co.

Spons' Encyclopædia of the Industrial Arts, Manufactures and Commercial products. No. 11. London: E. and F. N. Spon.

The Gas and Water Engineer's Book of Reference, with Companions. By Geo. Bower, St. Neot's, Hutingdonshire.

NEW BOOKS.

A B C (The) of Philosophy: a Textbook for Students. By T. Griffith. Crown 8vo. Longmans and Co.

Early Man in Britain, and his place in the Tertiary Period. By W. B. Dawkins. 8vo. Macmillan and Co.

Instructions for Fixing Telegraph Lines, &c. By L. Schwendler. Vol. 2. Second Edition. 8vo. Trübner and Co.

OBITUARY.

THE death is announced of Comte Benoist d'Azy, at the age of 84. Son of a Minister of Louis XVIII., he was one of the founders of the Crédit Foncier, and took a prominent part in the introduction of railways. He was a Legitimist Deputy from 1842 to 1851, and from 1871 to 1875. By virtue of seniority, he presided over the first sitting of the Assembly of 1871.

MR. WILLIAM PROCTER, M.D., of Petergate, York, died at the age of 64, at his residence, at an early hour on Sunday morning. The deceased gentleman was one of the honorary secretaries of the Yorkshire Fine Art and Industrial Exhibition, which was open during the summer months at York. Dr. Procter also acted as honorary secretary to the Yorkshire Branch of the British Medical Association, was a member of the Chemical Society, and in 1872 published a work entitled "The Hygiene of Air and Water," and also one on the "The Practical Chemistry of Non-metallic Elements." He did good public service by his valuable lectures to the members of the Yorkshire Philosophical Society and York Institute, of the former of which he was a vice-president, and of the latter a great supporter.

SIR JOHN B. MACNEILL, LL.D., F.R.S., died on Tuesday, at his residence in Cromwell Road, South Kensington, at the age of 87. The son of the late Captain Torquil P. Macneill, of Mount Pleasant, Dundalk, he was born in the year 1793. The deceased was well known in the engineering world, and was for many years Professor of Civil Engineering at Trinity College, Dublin. He constructed the railway from Dublin to Drogheda, on the opening of which, in May, 1844, he received the honour of knighthood from Earl De Grey, then Lord Lieutenant of Ireland. Sir John Macneill was the author of "Tables for Facilitating the Calculation of Earthworks in Railway Cuttings, &c."

FACTORY NOTES.

SALE OF AN IRON MINE.—On Thursday evening at the County Hotel, Ulverston, the Dalton Mines, the property of Messrs. Denney Brothers, were put up for auction. Mr. J. Robinson being the auctioneer. Mr. M. Kennedy of Alverston, was the purchaser through Mr. Henry Woolcock, C.E., of Whitehaven, at £21,500.

SANDWELL PARK COLLIERY COMPANY.—The directors have issued a circular announcing an interim dividend for the half-year ending December 31st, 1879, at the rate of 5 per cent. per annum on the paid up capital of the company. The directors state that the company has participated in the improved prices of coal during the latter portion of last year, but as the period of improvement has only been limited they consider it prudent to wait the close of the financial year before distributing a larger dividend.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 6th March:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Muesum, 11,128; Mercantile Marine, Building Materials, and other Collections, 1801. On Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 5 p.m., Mueseum, 1762; Mercantile Marine, Building Materials, and other Collections, 73. Total, 14,764. Average of corresponding week in former years, 16,080. Total from the opening of the Museum, 18,745,801.

NEW MEASURE IN THE OIL TRADE.—A letter from the Board of Trade, Standards Department, has been received, which states that with reference to the deputation from the oil trade which, introduced by Mr. Alderman Cotton, M.P., waited on Mr. Talbot on the 3rd ult., the request then put forward, that a new denomination of standard measure equal to five imperial gallons should be made and legalised, has been under consideration, and the necessary steps will be taken for the preparation of such a measure, of a shape similar to that generally used in the oil trade.

THE BOILER INSURANCE AND STEAM POWER COMPANY (LIMITED).—At the usual monthly meeting of the board, held at the head offices of the company, 67, King Street, Manchester, Mr, M'Naught in the chair, the chief engineer, Mr. M'Dougall (late inspecting officer to the Board of Admiralty), reported that during the month of February 6077 boilers had been examined by the officers of the company, of which number 53 were internally and 654 thoroughly examined. The principal defects found in the boilers were as follow:—Corrosion of plates and angle irons, 121; fracture of plates and angle irons, 28; safety-valves out of order or overloaded, 79; pressure gauges out of order, 55; water gauges out of order or fixed too low, 6; boilers damaged from overheating in consequence of deposit, 2; boilers damaged from overheating in consequence of deficiency of water, 6.

COOK AND COMPANY (LIMITED).—Vice-Chancellor Bacon on Saturday granted a supervision order in regard to the liquidation of Messrs. R. Cook and Co. (Limited), Hathersage, remarking that he found that the interests of the creditors and shareholders had not been properly protected. The petitioner, William Austin Cook, of Manchester and Sheffield, iron merchant, stated in his petition that the company was incorporated on the 1st of November, 1873, for the purpose of purchasing and working the Hathersage Works, in the county of Derby, wherein the business of making steel wire, needles, card hackles and gill pins and umbrella furniture, had been for many years carried on. The capital of the company was £15,000, divided into £10 shares, all of which were issued shortly after its incorporation, but 175 shares having since been forfeited for non-payment of calls, there remained 1325 shares upon which £9 per share had been paid. The company carried on business until February, 1879, when resolutions were passed for a voluntary winding-up, and Mr. John Unwin Wing, of Change Alley, Sheffield, was appointed liquidator. A committee of inspection was also appointed, consisting of Mr. J. W. Broomhead, Mr. J. S. Birks, and Mr. W. A. Cook. The petitioner was the holder of 425 shares, and a creditor for over £500, and his object in appealing to the court was to prevent a sale of the property to Mr. Broomhead, at the rate of 9s. 3d. in the pound upon the debts, the petitioner being of opinion that the assets, if properly realised, would enable all the creditors to receive 20s. in the pound.

ASSOCIATED MINEOWNERS (LIMITED).—A company has been formed under this title, with a capital of £300,000 in shares of £10 each, to acquire, work and develop mining properties, generally to act as agents for mineowners, supply mining machinery and for other purposes connected with this important department of industry. The direction is an influential one, and in Mr. T. Sopwith, C.E., the company will have a very efficient managing director of works. The board, in its prospectus, thus defines the scope and method of the association, they say:—As mining enterprise, especially when confined to one venture only, is necessarily of an uncertain and speculative character, this association has been founded by mineowners who are the holders of shares and debentures of several mining companies, their object being to secure the advantages of unification, concentration of management and average investments, and also to extend and strengthen their operations by the introduction of capital for the further development of their mines and for the acquisition and working of other eligible mining properties. The general basis of the association is to acquire an interest in and to find skill and capital to work and develop mines and minerals, giving a preference to the capital employed, and paying for the properties in deferred shares, the working capital advanced by the association being secured by a charge on the particular property to which it is applied." Among the more prominent of the works to be undertaken by the association is the exploitation of the gold fields of the Wynaad district, in the Madras Presidency, a notice of which appears in another part of our present number; and in our advertising columns will be found all necessary particulars regarding the association itself.

OPENING OF THE BALTIC.—A Reuter's telegram from Stettin states that eight steamers coming from Swinemunde forced their way through the ice on Monday, and arrived in the Stettin Harbour. Navigation for steamers has, therefore, recommenced.

AMERICAN GLEANINGS.

THE AMERICAN IRON OUTPUT.—A correspondent of the *American Manufacturer* says:—"The amount of iron manufactured in this country in the year past has been a half million tons in excess of the make of any previous twelve months."

THE PITTSBURGH RIOTS.—A full list of freight cars destroyed during the Pittsburgh riots has been furnished to the Allegheny County Commissioners by the Pennsylvania Railroad Company, as follows:—Box cars, 929; gondola, 367; stock, 33; flat, 5; coke, 76; dump, 9; unknown, 158; total, 1599.

AMERICAN MILLIONAIRES.—It is estimated that the following additions have been made to the fortunes of some of our principal millionaires by speculation and profitable investments during the past year:—Added to the Vanderbilt estate, $30,000,000; to the wealth of Jay Gould, $15,000,000; to the wealth of Russell Sage, $10,000,000; Sidney Dillon, $10,000,000; James R. Keene, $8,000,000; to the First National Bank, $2,000,000; to Drexel, Morgan and Co., $2,000,000; and to three or four other great operators, $3,000,000, giving a total of profits of $80,000,000 to about ten or twelve estates in a single year.—*New York Mercantile Journal.*

CONVICT IRONWORKERS IN THE UNITED STATES.—The State of Massachusetts has lately published a report on the employment of convicts in mechanical trades, and the effect of prison competition upon the interests of the working classes. The information has been gathered from all the States and Territories of the Union. The most numerous class of American convict workmen are boot and shoemakers. Next in prominence are the makers of iron goods, and numbering in the prisons of 14 States, 3504 persons. But the whole number engaged in this industry in the country is 137,545, so that little more than 2½ per cent. of American ironworkers are toiling in prison shops.

A RICH HEMATITE MINE.—A hasty glance at the now justly celebrated Norway mine, on the Menominee Railway, warrants the *Mining Journal* in saying that it is all that, and, probably more than has ever been claimed for it. If it does not reach a production of 200,000 tons the present year it will be simply because that amount cannot be raised out of the mine after the ore is broken. The deposit is simply immense, and production, for a few years to come at least, can only be limited to correspond with the number of miners that can be employed to advantage in the very extensive openings. A hematite mine capable of being made to yield 200,000 tons of ore in a single year was never before heard of in the history of iron mining in this or any other country.

THE AMERICAN STEEL TRADE.—On the 17th ult. a meeting of the merchant steel manufacturers of the United States was held in the Astor House, New York. It was deemed injudicious to make other than slight advances on the present card, and that only on a portion of the list. It was generally admitted that the profits on steel had been greatly reduced by the extraordinary advance in the cost of raw material used in its manufacture, but it was thought advisable that manufacturers should be content with the present narrow margin of profit. It was shown that foreign competition has not yet lost hope of recovering its former prestige and prominence, as the circular of the leading English firm, issued to the trade, states that the time has arrived to take advantage of the condition of the American market.

THE LABOUR MARKET.—The Sunderland Boilersmiths' and Iron Shipbuilders' Society on Saturday last sent a month's notice to the masters' secretary, asking for an increase of wages equal to what was taken from them in November—namely, 7½ per cent off piece prices. The riveters, who lost only 2½ per cent. off piece and nothing off time prices, have made a similar demand. On Tuesday afternoon a meeting of masters and men connected with the iron shipbuilding trade of Stockton and Hartlepool was held at Stockton, when the question of an advance of prices was considered. The men asked for an advance of not less than 5 per cent. on plating, and not less than 7½ per cent. upon riveting. This the masters present considered unfair, seeing that Mr. Dixon, of Middlesborough, had settled upon 5 per cent. all round, and Mr. Withy, of Hartlepool, employed carpenters. After some discussion, the negotiations were brought to a close, an understanding having been arrived at that each firm adopt its own prices, and make the best arrangements they can for their men. On Saturday morning notice was given to the 5000 artisans employed at the locomotive works of the London and North-Western Railway at Crewe, that on Wednesday morning full time would be resumed. About sixteen months ago, owing to the depression then prevailing, the employés were placed on three-quarter time, while about six weeks ago they were allowed three more hours per week; and now they will work the full 54 hours. Owing to the unexpectedness of the notice some little excitement was caused in the town, which is wholly dependent on the railway company. The South Staffordshire nail operatives on Wednesday accepted an enforced reduction of 3d. per 1000. The men recently gave notice of a demand for an increase of wages. On Thursday last week the coalowners of South Yorkshire and North Derbyshire met at Sheffield, and agreed on a new sliding-scale, provided that 5s. 6d. per ton shall be the minimum rate. No reduction in wages is to be made if coal and coke should fall below that figure, but every advance of 4d. above 5s. 6d. will carry with it a rise of 2½ per cent. in wages. There was no minimum in the original agreement. All the men employed at the Barrow Hematite Colliery, near Barnsley, have struck work, in consequence of the owners refusing to allow the 5 per cent. advance to a section of the employés, which the latter aver had been previously conceded. The pit has in consequence been set down. On Monday the employés of the Parkend Collieries Company, Forest of Dean, received notice to to terminate all contracts at the expiration of a week. 700 men are affected.

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—The reports received from none of the collieries, in this extensive district are of an encouraging nature, but on the contrary most of them bear a very distressed and disappointing tone. The tonnage of house-coal, which is being sent to London by the Great Northern is very moderate indeed, and this is demonstrated by the decrease on the revenue delivered from mineral traffic which last year amounted to £1912. Both the Silkstone and thick-seam pits are very badly off for orders for best house-coal, which limit the working days to three or four per week. There is also but a quiet trade doing in the same class of coal for the Eastern Counties and most parts of Lincolnshire. The Manchester, Sheffield and Lincolnshire Railway Company are however better off than was anticipated, for last week, fully 500 more tons passed Doncaster than was the case in the corresponding period of last year. A good deal of this, however, was steam-coal and fuel intended for Hull and Grimsby at both of which ports the shipments keep fairly up. The demand for steam-coal is, however, only quiet and scarcely so good as it was a month ago. There is very fair business doing in manufacturing coal for Lancashire and the West Riding woollen districts, but it is to be feared that the pending election movements will have a tendency to check this class of trade. The output of coke is proceeding with a rapidity almost hitherto unknown in the annals of district mining. In addition to the increased make at North Gawber, the Oaks, and other places the Dodwarth Silkstone and Iron Company (Limited) will shortly have 105 ovens at work, most of which have a capacity for keeping up a large output. A very important step has just been taken by the firm who leased or purchased two large blast-furnaces near Ambergate in Derbyshire, on the Midland line going to Buxton, the well-known watering place. The furnaces have been set down for five or six years, but nearly 50 men are at work putting them and the machinery into a thorough state of repair with a view of lighting them as early as possible. The furnaces will be supplied with coke direct from the colliery. In these days of failures respecting local societies it is cheering to learn that the newly established West Riding Miners' Permanent Relief Fund is progressing admirably. The annual meeting which will be held on Saturday week, will be presided over by Earl Fitzwilliam, Lord Lieutenant of the West Riding who is a noted coalowner. No alteration can be reported with regard to the strikes at Monk Bretton and Barrow Collieries, the old hands being still out. It is feared by some that the Barrow Company who are the owners of the colliery will close it, as they are making arrangements for supplies of coking material from other pits in the district. An important colliery plant at South Kirby, is announced to be offered for public competition at Barnsley on Monday week by order of the liquidators of the Rosedale and Ferry Hill Iron Company (Limited). The South Kirby Colliery is one of the finest and most moderate in the entire coalfield, the workings of which have as yet been scarcely developed. The position of the iron trade remains unchanged. The furnaces in blast are kept in full work and are producing a large output of pig iron. There is also a good deal of activity at the Bessemer Steel Works, where tires, rails and axles are largely made. Most of the foundries are fairly employed, but some branches are not over well patronised.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—There is a lull in the demand for hematite pig-iron, and from all quarters the request shows a weakening tendency. This, however, has no immediate effect on makers who are sold forward for several months, and who in many instances were not offering to sell before prices receded to their present quotation, but speculators have been clearing out stocks at 115s. for No. 3 forge, and No. 3 and 4 foundry iron, and at 120s. for all-round Bessemer qualities. This is practically a drop of 10s. per ton, but no makers have yet offered to sell at this value, as they anticipate, and not without reason, that prices will again advance, and that the demand will be again brisk when the spring season is opened and deliveries of iron are made to the Continent and elsewhere. It is not hoped that prices will be maintained at as high a figure as 130s. per ton, but it is thought that at present there is no prospect of a permanent drop while makers remain so full of orders. On every hand efforts are being made to increase the output of metal, by the relighting of furnaces now out of blast. Steel is in good enquiry and some fair parcels have been sold to Russia. Large deliveries have to be made during the year to America and the colonies Iron ore is weaker, prices having gone down in a corresponding ratio with pig-iron. The price current in the market is 28s. to 30s. per ton. Irish ore realises about 15s. to 17s. 6d. per ton delivered. Large cargoes of Spanish ore are being imported. Iron shipbuilders are doing a very steady business though they are not so well employed as they might be. The summer's trade, however, will be a brisk one. Engineers are well employed in the marine department, and generally speaking the trade is well furnished with work. The minor industries of boiler making, iron founding, railway rolling stock manufacturing, and steel wire making, are all fairly and in most instances busily employed. The coal trade, so far as consumption is concerned, is active, but prices remain low. Coke is in full request, and deliveries are quite adequate to the demand.

BIRMINGHAM.—No material improvement has yet manifested itself in the great majority of the local hardware branches of industry. Still, it must be admitted that the tone of business is somewhat more cheerful, and that in many trades orders have come to hand somewhat more freely, both as regards the home market and on account of colonial and foreign requirements. Altogether, the accession of new business has not been of any great extent, but the accompanying advices have, in many cases, been marked by gratifying assurances that prospects of the immediate future are decidedly improving. Makers of the heavier classes of goods turned out in the district, such as cast pipes, chains, anchors, &c., continue to be fairly busy, and the same may be said of bridge and girder makers, and firms engaged in manufacturing wheels, tires, axles and railway ironwork generally. Allusion was made last week to the placing in this district of some heavy orders for India. These, together with some recent Egyptian orders for the same class of work, will keep certain firms in full work up to the close of the Midsummer quarter. The last mail from Australia did not bring an average value of orders, the feeling in the colonies being apparently general, that ere long, a reaction in home prices may be expected, for which it is worth while waiting in the present condition of colonial stocks. There is still a good deal of work on hand for the Cape, and the demand from New Zealand is still reported to be fairly active. An improvement is noted in the leading South American markets, and a somewhat better request has been manifested for all classes of goods from India and Ceylon. From several markets, including Spain and the Levant, the Spanish, West Indies and South America, metallic bedstead manufacturers, report a better demand for the best class of goods; while Australia and New Zealand have been taking considerable quantities of the commoner makes. The month's trade, however, in this department, is still spoken of as below the average. Considerable shipments of gas, steam and water tubes have recently been made for Canada, and good consignments of the same goods have also gone to Australia and the markets in the North of Europe. An improved demand for watches is also repotted from the United States, accompanied by a 10 per cent. advance in prices. The home trade remains languid. It is true that in the agricultural districts a more hopeful spirit prevails than at any time since the collapse after the wretched harvest of last year, but little absolute reaction in business has been experienced. Retail dealers report that stocks are still heavy, and that money is still very difficult to obtain. The latter feature in the home retail trade is by no means confined to the rural districts, for even in those manufacturing towns in which the recent revival has been most distinctly felt retailers, say that it is by no means easy to obtain a settlement of accounts which are due. The activity in brass and copper braziery goods, which has been noticeable for some weeks past, is fully maintained, a brisk request having set in for spring goods for export. The local firms engaged in the manufacture of art metal-work are scarcely so well employed as is usual at this season. One house has on hand some good orders from the Corporation, including massive gates for the new Council House, and a few others have a fair sprinkling of orders for lecterns, coronas, &c., in brass, for church purposes. Mediæval gaswork is only in limited request just at present. The notices for the annual hardware contracts for the Navy, embracing locks and lock furniture, chain-rigging, iron eyes, bolts and hinges, stoves, screws, wire, black ironmongery, enamelled ware, tin and japanned wares. cutlery, files, copper nails and sundries, iron plate wares. weighing machines, needles, fish-hooks and other articles, have been engaging the attention of local houses during the past week, the time-limit for tenders expiring for the different groups on the 9th, 16th, and 30th instant. The qualities are less extensive than in previous years, but owing to the recent advances established in so many branches the range of prices will necessarily be considerably above the average of the last year or two. Owing to the late important amalgamation scheme in the screw trade a pretty general anticipation exists that now competition has ceased prices will shortly be advanced and will probably maintain a higher level. The leading firm has already announced that they will only accept new orders, subject to prices at delivery date, which will seem to indicate that there is good ground for the conjecture. There are still labour difficulties of minor importance in the chain and nail trades of the district. In the former some of the employers have conceded the 4s. 6d., per revised list, for all kinds of chain, demanded by the operatives and their men have recommenced work. A great number of masters still hold out, however, and over 1400 men are still out on strike, determined not to resume work till they obtain the same terms. In the nail trade one of the Halesowen firms refused on Saturday last to pay their men a higher rate than 10 per cent off the standard list agreed to at the close of the last strike. This the men refused to accept, leaving the warehouse without having their nails weighed-up. On Monday all the hands belonging to the firm were put on strike, and the committee of the Nailtorgers' Association propose supporting them out of the union funds till the masters consent to pay the list prices. The local iron trade has felt the influence of the drop in American orders, the improved condition of the home trade and the better demand from a few foreign and colonial markets being wholly insufficient to counterbalance the heavy decline in the United States trade. Under these circumstances it is not surprising that at the last weekly local meeting few orders were booked by the makers of best iron. They were not disposed to concede anything in the way of price, because they knew that in a few weeks wages would have to be revised and would in all probability continue at a higher level for some time to come. Makers of second qualities, however, consented to accept lower rates than were asked last month in cases where good specifications were offered. A very fair request has been shown for forge iron and also for bridge and girder plates, manufacturers in these branches being well under contract. Although there has been diminished activity in the market for pig-iron, the lull has not prevented smelters from adding to their powers of production, new furnaces being put in blast on all sides, so that we may look for a somewhat heavier increased output during next quarter.

Thursday Evening.—Iron trade: — Business on 'Change to-day very dull, and market weak; little done, except in job lots at reduced price. Makers' quotations unchanged, as most houses are still well employed on old orders. It is stated that specifications are not coming to hand as desired for some of recent American orders, indicating that recent demand was, at any rate, partially speculative. Marked bars firm at £9; unmarked may be had as low as £8. Pig-iron, better class, strong and scarce at £4 10s. for hot-blast. Cinder-pig weak and variable, and coal easier.

CARDIFF.—The iron market here reflects the symptoms that have been manifested elsewhere. There is activity at the works upon the orders booked months ago, but the outlook for new business has ceased to be a cheerful one. Owing to the increased cost of the materials essential to the manufacture, such as ore and coke, a healthy amount of current sales at the higher figures has been looked for to counterbalance the disadvantage of production under the old contracts; for, although in many cases the necessary materials were contracted for at past prices, this good fortune has been far from universal. Buyers seem to have made a concordat not to press the market and in order to induce business an abatement of some shillings has been made in quotations. It is, however, only a short time ago that a good order for iron rails was booked at £9 per ton. At the Cyfartha Works attention is being paid to the manufacture of merchant bars of a particularly fine quality. Production in steel seems to be at its maximum; there are no new transactions to report, because the plant is fully occupied and will be for some time to come. Notwithstanding the reaction that has undoubtedly supervened in the iron trade, there is no doubt entertained of the solid future before it. The advances are too sudden and rapid to last long; but that an increased volume of business is to be done this year no one questions. The Continental railway companies are known to have been postponing, till too late for their own interest, the repair of the permanent way, and the demand from America, if temporarily weaker, is safely counted upon returning in strength. As soon as prices have again reached the point of equilibrium, much reserved business will be placed. The situation as respects foreigners is much the same as reported last week; a decline has had to be submitted to by sellers. Prices of coke are still abnormally high, although lower than recently. The preparations for an increased make have been urged on so rapidly that the end of fancy prices cannot be foreseen except by sellers. The demand, however, is still extraordinary, if judged by the prices given for small coal at the ovens. This has reached the figure obtainable for the lump coal shipped at Cardiff. Owing to the pressure put upon the get of small, lumps are produced rather in excess of a healthy demand. In shipments of steam-coal considerable disturbance has taken place through the unusually severe weather. The docks are now inconveniently crowded, and despatch much impeded. Prices maintain the improvement, and for forward delivery—that is, beyond midsummer—higher figures are invariably secured. Outward freights are good, Malta being especially stiff. Baltic freights are, however, not strong, and grain cargoes quite flat.

CLEVELAND.—Tuesday's market showed that Glasgow still sways Middlesborough in the matter of prices to a very considerable extent. Business was done at 57s., 57s. 6d., and 58s., mainly by weak holders. Even lower prices were named, but there has been a good deal of "bearing." Makers are well sold, and most are out of the market for immediate delivery, so that the bulk of the business is in second hands. No. 3 Cleveland warrants can be had for 55s. nett. The finished-iron trade continues steady, as also ironfounding. The Tees shipbuilders have not yet settled their differences with their masters, still holding out on most unreasonable grounds. The revival is now making some sensible impression upon the general business of the district. The building trade, which had seriously declined, showing evident symptoms of having felt the stimulus. There has been a very large importation of Spanish ore for the steel works, showing that they are not yet nearly ready for adapting the native ore by the Thomas-Gilchrist process. This process is being carried forward slowly, but let us hope all the more surely. Coal and coke are steady.

DERBYSHIRE.—The iron trade throughout East and North Derbyshire presents but little alteration. Generally speaking, business holds very well up, notwithstanding the predictions to the contrary. The make of pig-iron is fully up to the average, and owing to the demand more furnaces will shortly be put in blast. There is a pretty good demand for gas and water pipes, which are largely produced at Staveley and other works. The pending dissolution is the general topic of discussion, and it may be stated that if no compromise be made in East Derbyshire the sitting member, Mr. F. Arkwright, and Mr. F. Wright, one of the partners in the Butterley Coal and Iron Company, will be the candidates in the Conservative interest. There has of late been but little change in lead mining, which, although an ancient branch of industry, is only carried on to a moderate extent. The coal trade is not so active as it was a short time ago, but on whole a large tonnage is being sent to London and the south, the chief of which is on account of contracts. The demand for other parts is not over active, and prices are rather lower. Steam or hard coal is in fair request for smelting as well as shipping purposes. Owing to the increase in the iron trade, there is a good demand for coke at fully last month's rates, although the output has been largely increased. The telephone has been successfully introduced into the district, and is used at one of the local collieries.

DURHAM.—Though there has been no relaxation of activity in the iron trade, prices, both of pig-iron and manufactured iron, have been weaker. The holders of pig-iron—at least second-hand holders—have not been able to withstand the heavy drop of prices at Glasgow, and hence have had to bring down their rates, and at one time this week almost 7s. per ton was the decline registered for North of England pigs on the week. A turn in the Scotch market would, however, quickly send up prices again, as the quantity of available pig-iron in the North of England is at the present time very limited. The report from America of a lull in the market, and lower prices, has also had a somewhat prejudicial effect. Pig-iron here has been sold as low as 55s. No. 3, and up to 56s. 6d. or 57s. The latter figures are the current rate at the present time. Manufactured iron has partaken in some measure of the quietude of pig-iron, though in this case there has been, contrary to what has been experienced in pig-metal, a slackness of demand, and to this alone is due the fact that about 10s. per ton reduction is noticeable in prices. This lower rate is not to be seen in the price lists of firms which have plenty of work, as they are standing at the old rates. Consumers can, however, readily place orders for plates at £9; bars, £8; angles, £8 5s. to £8 7s. 6d.; and iron rails (light sections), £8 7s. 6d. to £8 10s., less 2½ per cent. commission. At Witton Park, Bolckow, Vaughan and Co. have four out of their six blast-furnaces in operation, and all their available finishing plant, besides the erection of appliances for steel production which are in progress. The plate mills at Bishop Auckland are in full operation, and at Darlington the different ironworks are well employed. The Consett Iron Company have all their works going at full speed. If trade is rather quieter at the present moment, it is therefore no cause for disquietude, and probably everything would have been as strong as ever, but for the reduction of prices which we have alluded to in Scotland. The difficulty with the Durham cokemen is now regarded as being practically settled, the men having consented to refer their claim to the joint Committee. The remainder of the cokemen withdrew their notices at the end of last week. The price of coke is 16s. to 17s. per ton at the ovens. Manufacturing coal 5s. to 6s. 6d. at the pits, according to quality. Household coals still keep dull. It is expected that the general election will, more or less, interfere with the ordinary course of trade.

FOREST OF DEAN.—The announcement of an early dissolution of Parliament has evoked relief to the continued unfavourable reports of the Forest house-coal trade, and the partisans—Conservatives and Liberals—appear to be eager for the forthcoming fray. Perhaps, when the political unrest has subsided trade may improve, and the prospects of the country brighten. Commercially and socially this is much to be desired. There has been no quickening in the demand for coals, except manufacturing classes, which continues in fair request. It is feared that the house-coal proprietors will be unable to secure a return of trade. The mild weather on the one hand, and the rapid flight of the winter, scarcely give encouragement to any such hopes. Quotations are unaltered. Something approaching a "panic" has arisen this week in Dean Forest by the notices given to the Parkend colliers and employés to terminate all contracts at the expiration of a week. It has been stated that the proprietors intend closing their collieries, and the unfavourable balance sheet of the Bilson Collieries Company published last week certainly gave some colour to the rumour. There may possibly be a cessation of operations, but these are not believed to result in any prolonged stoppage. The facts appear to be that it has become inevitable to make some arrangements among the proprietary, and this led to the decision of posting the notices. The firms are holders of an extensive acreage of coals, both at their "New Fancy" and "Royal" collieries, and although prices are low it is believed that any prolonged stoppage would be attended with serious consequences. It is unfortunate that the chief member of the firm, Mr. Sully, of Bridgewater, is lying at the point of death at Weston-super-Mare. Forest iron ore continues to be in active demand, and the majority of the suspended mines have been or will shortly be again in full operation. This week the Easter Iron Ore Company have re-started a number of miners, and this important mine may be said to have been re-opened after an extended stoppage. On the eastern side of the mineral district the iron mines without exception are again in full swing, and thus compensation, to at least some extent, is made for the shortness of demand for house-coals. Messrs. Crawshay are turning out a large quantity of high-class pig at their Cinderford furnaces (three), and the firm are now well ahead. The lull in the iron trade hardly affects a district like the Forest, where the product is of a superior class of hematite iron. The district plate and wire industries are well placed for orders, and the mills are in full operation.

GLASGOW.—During the past week, the warrant market was very excited and a severe drop has taken place in prices, owing to the anxiety shown by shipbuilders to realise at any sacrifice, but there has since been some recovery of confidence, partly ascribed to a report that the Americans are again beginning to buy. America at present is the mainstay of the iron trade, and last week took about 12,000 tons of the total shipments from Scotland. There is little demand from the Continent or from Russia, as buyers there are keeping back their orders in the expectation of a collapse in prices, but if those now ruling could be maintained steadily for a short time a more general buying would doubtless spring up. On Thursday 63s. to 62s. 3d. cash was accepted, falling next day from 62s. to 59s. 7½d. On Monday opening at 60s. down to 58s. 3d. cash was accepted, advancing on the following day from 58s. to 61s. 7½d. cash. On Wednesday the price fluctuated between 61s. 6d. to 60s. cash, closing buyers 60s. 6d. cash and 60s. 10½d. a month, sellers 1½d. per ton more. Very considerable reductions have likewise taken place in makers' prices and they are selling little. Three new furnaces have been put in blast making 114 in all, against 89 last year. The shipments of pig-iron from Scotland last week were, foreign, 15,925 tons, coastwise, 2007 tons; total, 17,932 tons, against 13,910 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 3400 tons, against 6064 tons in the similar period of last year. The total imports till March 6, 1880, are 56,722 tons, against 50,528 tons till March 8, 1879, showing an increase for this year of 6194 tons. There is little change in Connal's stock of pig-iron, but little is now going into consumption, and it would seem as if storing had nearly ceased for the present. The manufactured iron trade is quiet, and as old orders are getting marked off it is found that new orders are not coming forward to take their place; consequently there has been an official reduction declared of 5s. per ton, but bar-iron could be bought at a further reduction of 10s. per ton. The exports last week were large, the chief items being for the East—machinery valued at £9527; manufactured iron at £8444; for Australia, machinery at £3578, galvanised iron at £2913, cast-iron goods at £1892; for the Continent, wrought-iron at £3026 and machinery at £2756; and for the West Indies, machinery at £2241. The shipbuilding firms are well employed, and the tonnage launched last week was satisfactory. The engineering and ironfounding trades are quiet. The coal trade is dull, and prices unremunerative, unless wages can be reduced, but the men are likely to be refractory if this is tried.

LANCASHIRE.—During the past week there has again been only a very limited amount of business doing in the iron trade of this district, and there was but a dull market at Manchester on Tuesday. The downward movement in Scotch iron has naturally had a depressing effect upon the market here, as it causes buyers to hold back any orders they are not compelled to place upon the market. There appears, also, to be a temporary suspension in the demand for export, and iron which has been bought upon American accounts, owing to the less favourable reports from the United States, is being offered in the home market. But, although holders in many cases are exhibiting signs of alarm, and second-hand iron is being pressed for sale at much under makers' prices, there is still a wonderful amount of firmness on the part of producers, most of whom have still so little iron to offer that they are in no want of anything like immediate orders, and can well afford to wait the turn of the market, which it is thought will fully recover its previous firmness as the shipping season opens, and the requirements of home consumers begin to develope themselves. For the present, the cheap second-hand lots which are offering seem to be pretty nearly sufficient to meet requirements; and, consequently, what business there is doing is at comparatively low figures. As, however, already intimated, makers continue firm. Lancashire smelters, although they are doing very little new business, are still busy on old contracts, on account of which nearly the whole of the iron they are at present making is being delivered, and they are not at all pressing for new orders; and for delivery into the Manchester district their quotations remain firm at about 70s. per ton, less 2½ per cent. In Lincolnshire and Derbyshire irons there is also no material change so far as makers are concerned, their quotations for delivery into the Manchester district remaining at about 75s. per ton, less 2½ per cent.; and it is only second-hand lots that are being offered at under this figure. In North-country iron there has been a good deal of underselling on the part of holders, and G.M.B.'s delivered equal to Manchester have been quoted at from 64s. 6d. to 65s. 6d. per ton net cash. Finished-iron makers are still generally busy, and most of them have orders on hand to keep them going for some time forward. For good Lancashire bars, prices as a rule are steady at from £8 15s. to £9 per ton, but second-hand lots are offered for delivery equal to Manchester or Liverpool at from £8 5s. to £8 10s. per ton. A gradual increase of activity is reported amongst the engineers and machinists, the revival in the local cotton trade bringing more orders into the hands of the latter, but these as well as orders for engineering work have to be taken at low figures, and founders still complain that they are not able to command for their manufactured goods prices in proportion to the increased cost of the raw material. The coal trade continues very dull, the supplies of all descriptions of round coal are still much in excess of the demand, and the pits generally are being put upon short time. Prices are very weak, owing to the anxiety to clear off stocks, and buyers prepared to take anything like large quantities for prompt delivery are able to place orders at very low prices. Best Lancashire house-coal at the pit's mouth is quoted at from 8s. to 8s. 6d. per ton, seconds at from 6s. to 6s. 6d. and common round coal at from 5s to 5s. 6d. per ton. The lessened production of slack is causing engine fuel to be rather scarce and prices have an upward tendency, good slack at the pit's mouth fetching about 3s. 6d. and inferior sorts 2s. 6d. to 3s. per ton. The shipping trade continues quiet.

LEEDS AND WEST YORKSHIRE.—Although business is no brisker in any branch of the iron trade than it has been for two or three weeks past, it is good enough to satisfy all who are content to wait patiently for a full restoration of prosperous times. Nobody can gainsay that trade has revived, and that, too, quite equally to all the expectations of reasonable people. For while two or three—it may be that there are four—of the largest forges in this district are working actually full time, and almost find that insufficient for their purposes, all the rest are working, at high pressure, four days weekly, while even in those cases some of the plant, such as plate-mills and finishing-hammers, are this week operating to the full extent of their capacity. The best Yorkshire iron makers are to be congratulated on the good demand which has arisen for boiler-plate. Some of them, almost to their very great surprise, have had demands made upon them for what they call the "old-fashioned" boiler plate. It is difficult to trace the destination of these plates of the ancient *régime*, but it is sufficient to know that it is required of the makers to pay particular attention to the quality, and the management are therefore requiring the greatest exactitude from their employés in that respect. A large turn-out is going on of bar-iron, both for home consumption and exportation. Although the contracts for the best brands have been taken at an advance upon the old rates, it appears to be doubtful whether new specifications would be as favourably accepted. The common-iron makers are quite as busy as others, orders placed before the recent drop in prices of pig not being yet finished, and therefore their business is perhaps rather more remunerative than it would have been had they now to compete for orders. Nailmakers are doing a steady business, though they say it can easily be shown that present prices make their's the poorest-paid trade that is going. As to large locomotive and tank-engine making, there is nothing to add to or alter in our last week's report. At the Steam Plough Works, were there only more of the legitimate business, as we may call it—*i.e.*, agricultural implement making—the condition of that vast establishment would be perfectly satisfactory. As it is, however, Messrs. J. Fowler and Co. are working full time in those branches which are famous for the production of compressed air-engines and other engines, machinery and tackling necessarily incidental to large colliery and quarrying operations. The coal trade does not acquire much additional energy. There is an intensity of competition which is much too keen for these prosaic and watchful times. Both prices are stationary, and the demand, week by week, is falling in arrear of the production.

LONDON.—The metal market here is again stronger after a little depression, prices, which dropped slightly last week, having somewhat recovered themselves. Scotch pig have been very largely dealt in at prices varying from 58s. 6d. to 61s. 6d., at which latter figures the market closes firm. Manufactured iron steady at slightly easier rates for the cheaper descriptions. Some curiosity is manifest as to the course of the forthcoming Birmingham meeting. It is not anticipated prices will go lower. Copper quieter all round. Chili bars, £68 5s.; English ingots, £75. Tin is better after its depression. Firm market, at £90 for foreign; English ingots, £94. Lead remains dull at list prices. Tinplates at present quiet. Cokes, 27s. Quicksilver, £7.

NEWCASTLE AND THE TYNE DISTRICT.—The condition of our iron and coal trades has this week been regarded as satisfactory, although conversation on the great Parliamentary *coup* of Monday, and local electioneering movements, has to some extent affected business operations on 'Change. All the ironworks in this locality are fairly busy, with a good prospect for the approaching summer. Recent prices are maintained for manufactured iron. Ordinary bar brings £8 5s. to £8 10s.; angles, £8 10s.; and ship-plates, £9 5s. Cleveland pig has here, as elsewhere, been weaker, but now there is rather a better tone in our market, in consequence of the more reassuring intelligence received from Glasgow. The general opinion is that the recent decline is altogether attributable to over-speculation. At Consett Ironworks orders have been secured sufficient to keep all departments fully employed until after the close [illegible] this year. about 200 puddling furnaces are going at these works, and upwards of 1600 tons of plates are being turned out of the mills every week. Walker Ironworks, one of the oldest iron manufacturing concerns in the North of England, and which has stood idle for several years, is at present showing signs of returning life. The two blast-furnaces are about to be blown-in. Engine and boiler works are full of activity, and foundries also are kept very well employed. The shipping yards are exceptionally brisk, but at some of the larger establishments there are complaints of a short supply of iron, by which work has been retarded. At Messrs. C. Mitchell and Co.'s shipyard a large turret ship is being built for the Chinese Government, besides other large vessels that are in progress; and at Jarrow every department of Palmer's works is in full work. Two more keels have been laid in Messrs. Leslie's yard at Hebburn in the past week. There are nine vessels in the stocks at that place, most of which are in the earlier stages of construction. The steam-coal trade of the Tyne has not been so prosperous as it now is for over five years past. It is having the usual lull that is always experienced on the eve of the opening of the Baltic trade, but contracts for forward shipment are of such a satisfactory nature that coalowners are very sanguine indeed that it will be a remunerative year. Contracts for immediate shipment are at the substantial advance of 2s. per ton over last year's average price, and the proprietors of steam-coal collieries are so well sold forward that they decline to quote at any price, except for almost immediate delivery. Gas and coking coals are also in good demand, and maintain the advance obtained before the close of last year. Coke sells at enhanced prices to the extent of 50 to 60 per cent. over those of last spring. The only branch of the coal trade of the north that is absolutely dull is that of house-coals, which sell slowly, and the prices for which have a tendency to slacken. There is a slight relapse in the chemical trade, but it is believed to be only temporary, as all the large manufactories on our river are working to their full capacity. Copper and lead works keep actively employed, and bottleworks and the plate-glass manufactories are busier than they have been for a long time past. Firebricks are easier to buy, either for present or forward requirements, than was the case only a few weeks ago. Cowen's and Ramsay's best brands are quoted at 50s. per thousand.

NORTH LINCOLNSHIRE.—The iron trade in the North Lincolnshire district is in a better position than at any previous period of its existence, which is only of moderate date. A good deal of activity is apparent on every hand. The output of pig-iron is very large, and efforts are being put forth to further increase the make of iron. The North Lincolnshire Iron Company have all their four furnaces in blast. The firm are engaged in putting down additional engine power for increasing the blast, as well as providing more siding accommodation. The Redbourn Hill Iron and Coal Company (Limited) have both their furnaces in full blast, as have also the Appleby Iron Company (Limited). At the Frodingham three out of the four furnaces erected are kept in full work. At the Trent Works, which are the oldest in the district, a good deal of alterations are going on. Three idle furnaces have been removed and two very powerful ones erected in their place. The owners are about to put down additional blast and engine-power, and hope to have six furnaces in blast as early as possible. The Smelting Company have their newly erected furnaces in full blast, so that with the exception of one furnace at the Frodingham Works, and those in course of erection at the Trent Works, all are in blast. There is a very good demand for ironstone, which is forwarded to all parts of the country. Large and increasing supplies of coke are being drawn from Durham and South Yorkshire daily, one firm alone rising forty trucks per day.

NORTH STAFFORDSHIRE.—Orders for finished iron are coming in very slowly, and the falling off in the demand which has been going on for several weeks is more marked. The works continue to be employed on contracts entered into some time ago, and but for which there would not now be a great deal to do. There is still an impression that further requirements for the United States will in the course of a week or two again fill the order-books, and most of the houses are building upon this hope. The bar mills are going nearly full time, and there is a good demand for plates and hoops, but inquiries for rails are fewer. Prices are tolerably firm, but they have ceased to show any sign of strengthening, and in some cases have revealed an opposite tendency. The forges are working as nearly full time as is consistent with the usual disinclination of forgemen to work regularly when there is plenty to do. Some fair orders for puddled bars have been received from America, and the domestic consumption is pretty good. Business in pig-iron has fallen off considerably. Some few orders have come from the States, but prices are uncertain, though rather easier than they have been. Transactions in ironstone have thinned very much of late. Most of the producers are, however, fully sold to the end of the quarter. Quotations are declining slightly. The coal market is decidedly dull, and sales difficult to effect. Rates are steadily falling.

NOTTINGHAMSHIRE.—The iron trade, taken as a whole, is active throughout the county, as compared with the state of business a few months ago. There is a very lively business doing in pig-iron, which is largely produced, whilst at Codnor Park, the Stanton and Awswarth Ironworks additional furnaces have either been or are about to be blown in. There is a good tonnage of Northamptonshire ores been received into the district. At many of the works the merchant mills and other kindred appliances are kept fairly going. The coal trade is scarcely so active as it has been owing to the markets being overstocked. Gas-coal is, however, in good request, and a good deal is being sent by rail to various parts of the Midland Counties and elsewhere. Business connected with steam-coal is also somewhat quieter, but it is thought that this branch of trade will hold up, seeing that a good deal of hard coal is being used for smelting purposes. The house-coal trade for London is not over active, but this cannot be wondered at, when the large output which is sent to the metropolis is taken into account. Local sales are moderate, but prices of most kinds of coal are not so firm as they were. There is a very fair demand for coke for smelting purposes. The prevailing topic of conversation during the past few day has been the dissolution of Parliament.

SHEFFIELD.—The iron market is this week in rather an unsettled condition, but quotations remain firm. There is no doubt that there has been over-speculation in the trade, and now that the time of settlement has arrived, the resources of some have been taxed. Political affairs have also had an effect on matters. On the whole, however, there is a degree of confidence exhibited as to the future which is encouraging. It is believed that the present is but a temporary lull, and that within a month there will be another advance in rates, and a stiff one. In these pages the advance in prices at the conclusion of the last depression was hinted a month before those advances took place. The information was correct, and again, from the same quarter, we are apprised of large orders of iron being withheld for a week or two, in the hope of better terms being secured. There have been some enormous purchases effected lately of Swedish iron, and these point to a probable heavy demand for high-class manufactured iron. Though, for the day, business is stagnant so far as fresh orders are concerned, yet there is a weight of work in hand which will keep the mills fully employed for some time to come. It is difficult to give quotations, but those of last week may be taken as a fair basis. Job lots for cash may be obtained for slightly under the rates of the day, but manufacturers will not commit themselves to large contracts even at the highest prices yet given. A caution is exhibited in business matters which is novel. Bessemer steels are very firm, and though last week it was reported that there had been a fall of £1 per ton, the market immediately recovered, as the leading converters refused to make any such concession. Bessemer billets are to-day fetching £11 per ton as against £4 15s. in October last. The above are cash quotations. The weakness of the past few days is attributable to this cause. In October, large quantities of iron and steel were bought on six months' bills. These bills are now falling due, and tightness of money is causing a temporary suspense. Every indication is that the trade will improve, especially when some of the old companies have cleared off contracts which were entered into last year. These have prevented increases of wages to men; but, now that business has got on a more legitimate footing, the market will be steadier and upward. The advance in the price of ivory is checking the better class cutlery trade. Forty per cent. in six weeks advance on ivory, and a short supply, has caused difficulties in the cutlery trade. File and saw manufacturers report more doing, and electro-plate houses are busier. The old staple trades are, however, only moderately employed. Cast steels remain with a dull demand, and no advances to note.

SOUTH STAFFORDSHIRE.—At most of the shops and factories there continues to be a steady run of orders, but in no department do prices manifest any greater strength. As compared with the commencement of the year, considerably more hands are finding employment. Travellers are sending home from the important consuming centres fair lines, and some manufacturers find themselves better supplied with orders than they were even a week ago. There have been some good mails delivered this week. With the Cape more business is being done than of late, and the South American markets continue to improve. The Australian mail has not, upon the whole, been so valuable as its predecessors, owing, it is believed, to the higher rates which are being asked. Drawn wire when the mail left had been in request, and for Nos. 6, 7, and 8, £13 10s. to £15 was quoted, but no great sales are announced. A rise of 10 per cent. had been secured for tin plates, and ordinary brands of galvanised iron fetched £25, and best brands £26 to £26 10s. The finished-iron works have not this week all the specifications they would like, and therefore for immediate delivery proprietors are quoting lower rates. Sheets (singles) are £10 10s., and some brands may be had at even 5s. lower. Nail sheets can be purchased for £8 10s. and £8 12s. 6d., though the open market quotation is £9. Pigs are selling well at £4 10s. for native all-mine sorts. Cinder pigs are £3.

WEST CUMBERLAND.—The output of the furnaces throughout the district is very considerably larger than of late, but nevertheless it is all going into consumption, and makers have at the same time a difficulty in meeting their delivery ennagements. On the other hand, the market displays a quieter tone, and sales are reported to have been effected at 7s. 6d, to 10s. per ton below the quotations of a month ago. Bessemer iron has been sold at 122s. 6d. per ton for all-round qualities, and in one or two instances lower figures still are reported. Forge iron of No. 3 quality has fallen to 115s. per ton, and foundry iron of Nos. 3 and 4 quality is quoted at 112s. The sales at these figures, however, are comparatively small, as makers in the meantime are withholding from the market in the hope of a revival in spring, and second-hand parcels are finding their way into the hands of buyers. There is an absence of all speculative demand, but there is a general feeling not only from the large orders already held, but from the prospect of a brisk demand during the summer, that the season approaching will be the most active period during the past six or eight years. Steel rails are in demand, both for home and foreign consumers, and prices are undisturbed at about £11 per ton. Other qualities of Bessemer steel are in considerable request and it is anticipated a brisk demand will be experienced during the year for merchant qualities. With this view makers are laying themselves out for a larger trade. Shipbuilders are busily employed in some instances, but as there are two or three yards which have been closed for some time owing to exceptional circumstances, this industry is not furnishing so much employment as would be the case under other circumstances. The finished-iron trade is busily employed, and the demand experienced from all quarters is very considerable, and makers are making arrangements for an increased output.

Fires in America.—$353,000,000 worth of property was wasted by fire in the United States during the last five years. The number of fires is surely and steadily increasing. The number of fires causing a loss of $100 and upward, in 1876 was 9301. In 1879 it was 12,849, an average of about one fire every forty minutes.—*New York Mercantile Journal.*

CONTINENTAL MINING AND METALLURGY.

France.

FRANCE, like Belgium, appears at the present moment more disposed to consolidate its position than to improve upon it. Things will do very well as they are, if they can only be kept as they are for a sufficient period of time to let unprofitable business run its course and earnings accumulate. Hence there is a fear of intimidating buyers by a continued hardening of rates, although it is considered probable all round that they will eventually rise to a level up to which it is not prudent to force them just now. *La Metallurgie*, for instance, knows of a lot of 200 tons of beams taken at Paris at 250 fr. (£6), and another lot of 300 tons taken at 265 fr. (£6 12s. 6d.) the lower priced lot being for immediate delivery, the higher priced lot being for delivery next August. Evidently, merchants who were fortunate enough to secure heavy deliveries at the beginning of the revival are very well able to sell now at rates which seem comparatively moderate; but the business thus done can hardly be termed current business. In Paris the activity in building operations is unusually great. Last year a considerable number of houses were built for letting, and it was for some time feared that building had been overdone. As, however, last year's speculations have succeeded very well indeed, capital is again flowing in for this class of constructions, while, as we have mentioned in previous issues, trade requirements are growing in Paris. In the direction of Clichy, Asnières and St. Ouen, several factories are being put up, and they have to be supplemented by the *cités ouvrières* in which alone the hands can be lodged. The Paris Gas Company, for example, which is finishing its new works at Clichy, will have to find house accommodation for something like 3000 workmen, and with the generalisation of systems of construction, of which the chief elements are brick and iron, the local demand for beams promises to be as steady all through 1880 as it was at the beginning of the year. The nominal present rate for beams is still 280 fr. (£11 4s.), for plates 310 fr. (£12 8s.) to 320 fr. (£12 16s.). There is thus for the present a virtual equilibrium between supply and demand. Business has now reached a paying level, and is quietly working its way along it, satisfied that the prospect is clear for some six months at least. As Belgian prices are now nearly as high as French, fewer contracts are sent out of the country, and business is, of course, all the steadier from not having to endure the constant shock of competition.

For the 2000 goods vans which the Northern of France intends to have built, contracts will, it is said, be invited very shortly. The Lyons Tramways is negotiating for 150 cars, and will presently need 1000 tons of rails. Pig continues to be scarce in Eastern France. Forge pig is quoted nominally at 105 fr. (£4 4s.), but there is very little really for sale, all being sold forward at Nancy and Longwy up to the end of the year, without taking account of stoppages in manufacture due to accidents or repairs. At Nancy, 110 fr. (£4 8s.) has been given as a price by makers, but *L'Ancre* is tolerably certain that they really had nothing to sell. The Nancy "Comptoir" has not been acting very regularly, makers having taken on themselves to reply singly and separately to inquirers. This laxity is about to be remedied, and commercial arrangements will henceforth be made by the Comptoir exclusively. *L'Ancre* explains the fact that quotations have been made as low as 102 fr. by stating that such quotations have been made only by brokers who, having bought early, are now desirous of realising; the decline is therefore merely apparent and factitious.

In the Ardennes nail sheet has been put up 5 per cent. since March 5th, being the third advance in three months.

In Haute-Marne mills are harassed for prompt delivery, and prices are firm at 250 fr. (£10) for coke irons, and 275 fr. (£11) for mixed. The foundries are busy, with rising rates. Cast-iron columns (solid) sell at £7 4s. for heavy contracts: builders' castings, in the flat, are quoted £12. At Paris this class of goods is gradually rising.

The Loire and Rhone exhibit the same prudent reticence and moderation in their treatment of consumers as the other ironmaking districts of France. Business is encouraged by prices being held firmly at as moderate rates as are consistent with the dearness of raw material, and forgemasters will be very well content to be allowed to go on holding their own. There are some very large contracts in hand in the Centre, and although order books are not filling up so rapidly as during the dawning of the revival, fresh "lines" are not wanting, and the prospects of railway and Government work continue good. The *Journal des Mines* gives a summary of the operations of the Terrenoire Company during 1879 and 1878, thus:—

	1879. tons.	1878. tons.
Output of coal	98,498	108,493
" ironstone ..	112,569	181,803
Make of pig	125,093	146,831
Tonnage of castings ..	12,549	14,901
Make of iron	39,012	39,899
" steel	96,399	95,439

There has been a strike amongst the puddlers at the ironworks owned by Dumont and Co., at Louvroil (Nord). The men demanded an increase in their wages of 15 per cent., and were offered 10. A compromise was come to, and puddlers now get from 7 fr. to 8 fr. (5s. 6d. to 6s. 4d.) per day, and hammermen from 10 fr. to 11 fr. (8s. to 8s. 10d.). At the other works in Louvroil, and at Maubeuge, wages have been "revised"—that is to say, raised—by the majority of managers, in anticipation of any demand on the part of the workmen. The Providence and Saint Marcel forges, in the same department, have been inundated by the Sambre, which has put out the fires, and thrown 600 men out of work for some days. At Pont-à-Vendin is being built a large factory, where furnace coke and patent fuel will be made, and iron, zinc and copper ores, both from the interior and from abroad, will be treated. The foreign supplies will come by way of Dunkirk and Calais. The Ardennes Forge and Nailworks, a new and large concern at Mohon (Ardennes), was started at the beginning of February last. At Villerupt, near Longwy, (Meurthe-et-Moselle) M. Ferry is building a second blast-furnace of large capacity. It will not be ready to start for about eighteen months. At Havre a new galvanising factory is in course of erection. It will be of very considerable extent, the largest bath being intended for the treatment of pieces up to 70 feet in length.

The rebuilding of the Bercy warehouses has been taken up again with great vigour. Amongst Paris improvements are to be noticed the illuminated clocks now erected at the Place de l'Opéra and the crossing at the Rue Richelieu. It is intended to erect others in other open spaces where the dials can be well seen. The whole system will be in pneumatic communication with the Observatory, and mean time will thus become public property. The system of pneumatic regulation was first, we believe, reduced to practice in Vienna. Experimentation with the electric light in the Avenue de l'Opéra is to be continued for another year—that is to say, till March 1st, 1881.

The Academy of Sciences held its annual public meeting on March 1st, when the Lacaze prize was awarded to M. Boisbaudran for his discovery of gallium, and a prize of £120 to Mr. William Crookes for his successful experimentation in various branches of science. The Academy will award an extraordinary prize of £240 in the department of mechanics in the course of the present year, MSS. to be sent in to the secretary of the Institute of France, before June 1st next.

M. Solacroup, the late manager of the Orléans Railway Company, has been succeeded by M. Sévène, a distinguished engineer who has been for twenty-eight years in the service of the company. M. Eugène Mir has concluded his report on the proposed Havre and Tancarville canal, for which the first surveys were made in 1877. The project is part of the De Freycinet scheme of public works, and a bill for its adoption will follow on the acceptance of the present report by the Chamber, should the Chamber see fit to vote the £80,000 required for the construction of the canal. Starting from Tancarville Point the canal would cross the river below Harfleur and be led into the Eure basin at Havre, after a course of 15 miles. A saving of 2 fr. per ton in water carriage between Havre and Paris is reckoned on. In 1878 Havre received 1,580,000 tons of goods from abroad, and exported 380,000 tons. Northern colliery owners view the project with disfavour.

The Paris goods stations of the railways being now pretty clear and service by water being now practicable, coal has been brought into Paris in considerable quantities, and the famine it endured during January is at an end. The maximum price per short ton for best house-coal delivered is only £3, and supplies of good fuel can be obtained at £2 16s. Manufactured coal continues very firm and demands are steady. *La Nature* estimates the world's output of coal in 1879 at 284,000,000 tons, which heaped in one place would form a veritable mountain.

Belgium.—The metallurgical trade of Belgium, inwards and outwards, for the month of January of the present year, compared with the amount for the same month in the two years immediately preceding is thus tabulated by the Belgian Ministry of Finances:—

	1880. Tons.	1879 Tons.	1878. Tons.
Imports:—			
Steel	219	196	148
Pig-iron	16,381	—	—
Scrap	1321	—	—
Wire	250	122	161
Rails (iron) ..	12	310	7
Plates	30	8	8
Section irons ..	579	315	330
Nails	76	20	33
Unclassed irons ..	319	145	273
Castings	100	109	71
Ores and borings, &c.	49,321	54,740	64,820
Coal	90,263	58,978	56,153
Coke	1477	950	1031
Exports:—			
Steel (all classes)	54	48	803
Pig-iron	1,667	—	—
Scrap	3,039	—	—
Wire	333	269	91
Rails (iron) ..	1,759	2,650	443
Sheet	1,944	1,133	1,775
Section irons ..	10,504	7,545	6,110
Nails	505	503	391
Unclassed irons ..	1,067	668	694
Castings	210	74	326
Ores	20,384	19,847	20,019
Coal	399,287	365,446	266,857
Coke	60,992	44,509	42,479

The Ministry of Finance now discriminates for the first time between pig-iron and scrap, in consequence, possibly, of late heavy exports of the latter material making a separate classification desirable. Almost the whole amount of the scrap exported was sent to America. The Ministry has not yet adopted any separate classification for steel rails, and it is, accordingly, difficult to know what the Belgians really export in this article.

A certain unsteadiness is noticeable in the market of Belgium. The standard of 210 fr. (£8 8s.) does not, says the Liége *Semaine*, seem to be at all firm. Statements made on behalf of the producer affirm that in Belgium, as elsewhere, early buyers are profiting by the present high level of rates to secure the sale of their own cheaply-acquired bargains. However this may be, here are some who doubt whether prices will harden with the opening of the spring campaign which, indeed, is already open. The *Semaine*, however, is confident as to the future, and believes that floating stocks will be promptly absorbed, and that fresh orders will thus fall in. The Grivegnée mill, according to the Brussels *Intérêts*, has lowered its quotations by 20 fr. (16s.), after being amongst the most prompt in raising them. Pig has brought £4 in the district of Liége, although the Belgian market is affected by the fluctuations of the markets of Glasgow and Middlesborough. Steel keeps the level it has acquired, and, as yet, shows no signs of weakness, The following are a few quotations for industrial stock, taken from the lists published by the Brussels Exchange :—

	Nominal value. fr.	March 1 fr.	March 4 fr.
Cockerill	1000	1117·50	1095
Espérance	500	195	182·50
Selessin	325	362·50	360
Angleur Steelworks ..	500	850	—
Athus Ironworks	1000	1800	1750
Acoz	500	365	332·50
Luxembourg Ironworks ..	1000	825	800
Monceau-sur-Sambre ..	500	870	865
Ougrée Ironworks	1000	1075	1050
Providence	1000	1650	1650
Thy-le-Château	1000	1900	—

The Minister of Public Works, M. Sainctelette, publishes in the *Moniteur belge*, of the 5th inst., a table setting forth the causes of the boiler accidents which took place in Belgium in 1879. They were only four in number altogether; two took place in January, two in December, two in collieries, one in a brewery, one in a flour mill. The cause of accidents was found to be, in the first case, a defective plate, which had already been repaired; in the second the feed cock was out of order; in the third the plates were worn down by corrosion, owing to the water; in the last, the plate was found weakened along the line of the rivets. The four accidents had a total of six deaths consequent upon them.

As is the case with the coal trade in every country on the departure of winter, the demand for house-coal in Belgium, has slackened considerably. On the other hand the demand for manufacturing fuel of all kinds continues excellent. The brick trade is preparing for a campaign of unusual vigour, and is contracting for large supplies. Except on the Northern of Belgium, the service by railway is now again satisfactory.

GERMANY.—German trade has been less tumultuously prosperous during the past two weeks, and merchants' prices, if not makers', are certainly weaker. It is said in Germany as elsewhere that there many dealers who have bought oo heavily and are now underselling makers for the purpose of forcing sales, but that makers being booked well forward, do no care to retaliate. If we may trust official lists rates have not declined very much, the following table showing the official maximum quotations at Dortmund and Dusseldorf at the beginning of last February and March.

	Dortmund Feb. 2.	Dusseldorf. Mar. 1.
German foundry pig ..	£5 5 0	£5 5 0
German Bessemer pig	6 0 0	6 5 0
Common bars	10 15 0	11 0 0
Boiler plates	13 10 0	13 15 0

For steel rails, German Bessemer pig, and German foundry pig, prospects are said to be very favourable, and the future production of these goods may probably take place at enhanced rates. On both the western and eastern sides of the Empire mills are working steadily and do not exhibit any great anxiety for new business. Nothing has been heard recently of sales of scrap on American account, but its price is well maintained. For 1000 tons of rails put up to tender at Stettin on February 23rd the lowest offer was that of Hoesch (Dortmund), £12 10s.; Hörde asked £12 16s.; Krupp did not tender; English offers, with duty, came to £13 4s. At Strasbourg on the same day tenders for 5000 tons of rails were opened, the lowest German tender being that of the Rothe Erde Works, £11 15s. There was an English offer of £11 12s. delivered at Antwerp. The majority of the offers ruled over £12. For 4500 tons of iron longrines the lowest offers were £8 10s. and £8 18s.

The *Essener Zeitung* points out that the rise of 100 per cent. which has taken place in the cost of pig-iron does not imply that manufactured iron should double its price. Pig and coal are not the only factors of cost—wages, maintenance of plant, counting-house expenses, repairs, carriage, &c., are also determinative, and these latter expenses have not been much increased. As a matter of fact, the 100 per cent. increase of cost is reduced to an increase of only 60 per cent.; and bar-iron selling at £11 can perhaps afford to pay double rates for raw material. And so with plates, rails, wire, &c. The greatest profit is made by blast-furnace owners, who, selling at 100 per cent over old rates, have but a comparatively small increase in expenses to set against their new profits. On the other hand, even where full current rates are obtained—and this is not the case everywhere—it does not follow that any large profits are being made. With pig at £5, bar-iron cannot be made for less than £10, and this, with rates at £11, leaves only £1 per ton.

The Berlin *Boersen-Zeitung* states that seven firms in Germany have now taken out licenses to work the Thomas-Gilchrist process—De Wendel, Burbach, Stumm, Dietrich, Dillingen (Alsace-Lorraine); Rothe Erde, near d'Aix-la-Chapelle, Marienhütte (Saxony). A contract for 80,000 tons of steel rails, the delivery of which is to be spread over three years, is said to have been taken by the powerful house of De Wendel. The Bessemer plant of the Stanhaüser Hütte, at Witten, has been sold to go to Belgium.

Statistics have been published of the metallurgical operations of the Dortmund district during 1879. There were sixteen ironworks in the district, with sixty-three furnaces, forty-three of which were on blast.

Fine tools are said to be tempered in some parts of Germany by heating to a white heat, plunging into sealing-wax, withdrawing after an instant, and re-plunging till the tool is cold.

On the 15th inst. begins a theoretical and practical course of electrotyping in the Nuremberg Museum of Trades, lasting four months. It costs £10, but in the second month a wage is paid of 10s. per week, rising to 20s. Only such pupils will be taken as can pass a preliminary examination in general knowledge. Representatives of the fourteen technical schools in which the German language is the medium of instruction, are invited to meet the Rector and Senate of the Royal School of Trades at Berlin on the 31st inst.

NEW PATENTS.

All the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 909 to No. 1006, being the entries from March 2nd, to March 8th.

NEW APPLICATIONS.

Aerated Waters.—*A. Gascoigne, London.* [922

Aerated Waters.—*R. L. Howard, Luton, Bedfordshire.* [926

Aerial Navigation.—A communication.—*W. R. Lake, Southampton Buildings, London.* [985

Apparatus for Cutting and Trimming Paper.—*F. Knoeferl and W. Fuller, London.* [914

Automatic Clocks.—A communication.—*H. Palm, Vienna.* [920

Bed-Clothes Elevators.—*J. W. Cousins, Portsmouth.* [988

Bicycles.—*C. Wickstead, Kettering, Northamptonshire.* [1001

Bleaching Straw Fibres.—A communication.—*F. C. Glaser, Berlin.* [938

Breechloading Fire-arms.—*P. T. Godsal, 52nd Regiment.* [979

Breechloading Fire-arms.—*W. W. Greener, Birmingham.* [939

Brick Kilns.—*G. Wray, Rotherfield, Sussex.* [927

Canvas Hose.—*F. G. Henwood, London.* [953

Caps for Mine Cartridges.—A communication.—*J. H. Johnson, London.* [939

Carriage of Grain, &c., in Bulk.—A communication.—*W. P. Thompson, London.* [929

Cast Iron Pipes, &c.—*J. W. Macfarlane, Lanark.* [919

Changing Shuttles in Looms.—A communication.—*J. Imray, London.* [966

Check Register for Bills, &c.—*F. T. Bond, Gloucester.* [935

Coal-tar Products.—*S. Clift, Conway, Wales.* [967

Communication on Railway Trains.—*H. Morris, Manchester.* [931

Condensed Milk.—A communication.—*W. R. Lake, London.* [917

Cricket-bat Handles.—*W. Rushton, Wolverhampton.* [965

Discharging Apparatus for Furnaces.—*W. Jones and J. Walsh, Middlesborough-on-Tees.* [976

Disinfecting Apparatus.—A communication.—*J. H. Johnson, London.* [1005

Drawing Liquids from Bottles, &c.—*F. E. E. Hooper and A. G. Lake, London.* [980

Driving Gear for Mangles, &c.—*E. Taylor, Salford.* [959

Elastic Beds for Power Presses.—*L. Sterne and J. B. Handyside, Glasgow.* [948

Electric Lamps.—*J. H. Guest, Brooklyn, U.S.A.* [925

Embossing Presses.—*J. James, Lambeth, London.* [951

Fastening Apparatus for Gloves, &c.—A communication.—*W. P. Thompson, London.* [916

Felted Thread.—A communication.—*W. Barlow, London.* [915

Fire-arms.—*J. S. Heath, Birmingham.* [984

Fire-damp Indicator.—*J. Aitken, Falkirk, Stirlingshire.* [963

Forging, Punching, &c., Machinery.—*A. J. Acaster, Sheffield.* [958

Gas Burners, &c.—*G. E. Webster, C.E., Nottingham, and W. E. Fisher, Birmingham.* [994

Gas Retorts.—*A. Mackie, London.* [947

Glass Manufacture.—*A. E. A. de Bouteyre, Paris.* [905

Hoisting Blocks.—A communication.—*H. J. Haddan, Strand, London.* [910

Horse Rakes.—*E. H. Tooley, Holwell, Bedfordshire.* [932

Hydraulic and Steam Lifts.—*J. and J. Shaw, Salford, Lancashire.* [960

Hydrostatic Coffee or Tea Pot.—*E. Bazin, Paris.* [998

Iron Fenders.—A communication.—*R. Roberts, Birmingham.* [972

Jacquard Looms.—*T. Blackhurst, Preston, Lancashire.* [950

Knitting Machinery.—A communication.—*A. W. L. Reddie, Chancery Lane, London.* [942

Knitting Machines.—*W. Cotton, Loughborough, Leicestershire.* [983

Lamps and Boxes.—*F. W. Monck, Birmingham.* [997

Lifting Sunken Vessels.—*W. R. Mowbray and E. Murley, Hull.* [944

Lighting and Illuminating.—*D. Hynd, Dundee.* [962

Lock Nuts.—*J. F. Wiles, London.* [1003

Lubricating Spindles, &c.—*W. and S. Taylor, Oldham.* [974

Lubrication of Frictional Rubbing Surfaces.—*J. Mitchell, Plantation, near Glasgow.* [970

Meat and Vegetable Essences.—A communication.—*W. E. Gedge, London.* [923

Mechanical Organs, &c.—*J. Y. Smith, London.* [954

Metal Hurdles.—*J. H. Gillett, Wolverhampton.* [913

Mine Ventilation.—*T. Sutherst, London.* [982

Mixture for Starching Linen, &c.—*T. Lancaster, Fulham, Middlesex.* [937

Moulds for Castings.—*J. Crosthwaite, Borrowstouness.* [912

Nail Manufacture.—A communication.—*G. W. von Nawrocki, Berlin.* [991

Ocean Steamers.—*J. G. S. Anderson, London.* [996

Organs, &c.—A communication.—*C. Kesseler, Berlin.* [961

Oyster Beds.—A communication.—*M. Bauer, Paris.* [975

Papermaking Machines.—*R. Brodie, Leith, Midlothian.* [992

Phosphate Manufacture.—*W. J. Williams, Chester.* [993

Pipe Wrench.—*W. J. McCormack, Paignton, Devonshire.* [978

Production of Cyanides.—A communication.—*J. H. Johnson, London.* [1004

Production of Motive Power, &c.—A communication.—*A. M. Clark, London.* [1006

Purification of Iron.—*Sir H. Bessemer and A. G. Bessemer, London.* [987

Railway Brakes.—*J. Clark, London.* [924

Railway Carriages and Rails.—*J. Reid, jun., Feal, Kinross, North Britain.* [969

Reworking Iron Shearings.—*J. H. Rogers, Llanelly, Carmarthenshire.* [986

Riveting, &c., Machines.—*R. H. Tweddell, London, and J. Platt and J. Fielding, Gloucester.* [981

School Desks and Seats.—*J. Glendenning, Thorpe, Norwich.* [990

Scribbling and Carding Engines.—*S. Tempest, Hunslet, near Leeds.* [936

Securing Knobs.—*R. Wright, Richmond, Yorkshire.* [999

Sewing Machines.—*J. Scott, Liverpool.* [934

Ships to Carry Cargo in Bulk.—*W. R. Oswald and G. Stavers, London.* [957

Sifting Machine.—A communication.—*W. R. Lake, London.* [915

Smoothing Iron.—*A. Norris, London.* [933

Solitaires, Shirt Studs, &c.—*J. Candelent and G. Adams, Birmingham.* [971

Spinning Fibrous Materials.—*E. Riley, Droylsden, Lancashire.* [946

Spinning Mules.—A communication.—*J. Hendry, Partick, Lanarkshire.* [977

Spray Distributor.—*T. H. Bentley, Scarborough.* [964

Springs for Fastening Gloves.—*E. Horsepool, London.* [943

Steam Boilers.—A communication.—*L. Varicas, London.* [909

Steam Engines.—*F. W. Durham, New Barnet, Herts.* [911

Stereotype Plates.—*R. B. Reed, Newcastle-on-Tyne.* [928

Steel Manufacture.—A communication.—*S. Pitt, Sutton, Surrey.* [952

Stoppering Bottles.—A communication.—*W. R. Lake, London.* [955

Stoves, &c.—*S. C. Davidson, Belfast.* [968

Straw Fans, &c.—*O. Thaege, London.* [983

Telephones.—*R. H. Courtenay, Fleet Street, London.* [941

Tobacco Pipes.—*W. B. Haas, London.* [949

Umbrellas.—A communication.—*A. M. Clark, London.* [913

Washing, &c., Machines.—*J. Cherk, London.* [973

Watches.—A communication.—*W. R. Lake, London.* [1002

Winding Machines.—A communication.—*A. C. Henderson, London.* [1000

Window Blinds.—*J. W. Meacher, Camden Road, London.* [921

Windows and Window Frames and Sashes.—*H. Brittain, Birmingham.* [956

Writing Instruments.—*W. E. Wiley, Birmingham.* [940

COMMERCIAL.

NEW COMPANIES.

BRAZILIAN GOLD MINES.—Upon terms of an agreement of the 19th ult., this company proposes to acquire from Mr. William Greig, of 2, Avon Villas, Gladstone Road, New Wimbledon, the Santo Antonio Estate, situate in the province of Minas Geraes in the Empire of Brazil, and the several rock formations or lodes of metallic auriferous jacolinga and other lodes of ore, known as the Descoberto Mine, the Matta Matta Mine, and the Servizo Velho Mine. The company was registered 25th ult., with a capital of £80,000 in £1 shares. The purchase consideration is £14,000 in fully paid shares, and £6000 in cash.

DECORATIVE ART.—Registered 25th ult., with a capital of £20,000 in £5 shares, with power to increase, to acquire and work letters patent dated 10th of November, 1877, No. 4324, granted to Mr. Thomas Young for the invention of improvements in stove ornaments or appliances for screening fire-grates or fire-places and in machinery employed therein. The purchase consideration is 2000 fully-paid shares.

FLAVILLA MINING.—This company was registered 25th ult., with a capital of £100,000 in £2 shares, to acquire and work mines in the territory Utah, U.S.A., formerly the property of the Chicago Silver Mining Company (Limited).

INDIAN GLENROCK GOLD MINING.—This company was registered 16th ult., with a capital of £100,000 in £1 shares to carry into effect an agreement 24th Jan. for the purchase of the Glenrock estates, situate near Pundaloar, in the South-east Wynaad, in the Presidency of Madras. The purchase consideration is £50,000, payable, £17,000 in cash and £33,000 fully paid-up shares. The prospectus of the company was extensively advertised and circulated several days prior to registration, although, as a duly constituted company, it had then no existence.

INDUSTRIAL EXHIBITION.—The object of this company is the organisation and maintainance of exhibitions of scientific and industrial art productions, in the United Kingdom and elsewhere, and to purchase sell, and deal in such productions. It was registered 21st inst. with a capital of £10,000 in £5 shares.

LONDON AND PROVINCIAL MARINE INSURANCE.—This the application of limited liability to the above company in accordance with a resolution passed at an extraordinary meeting of the shareholders, held at Cannon Street, on the 10th ult. The company was originally constituted on the 20th of January, 1860, by provisional registration, and completely registered by Deed of Settlement, 28th April, 1860, with a capital of £1,000,000 in 50,000 shares of £20 each. It was incorporated 26th ult., under the present Acts, and its returns shew that the whole of the shares are allotted and that £2 has been paid upon each.

LUSTRO CHEMICAL.—Registered 27th ult., with a capital of £10,000 in £1 shares to purchase the business of the Lustro Chemical Company with plant, &c., belonging thereto, and to carry on business as chemical manufacturers and merchants, and drysalters in chemicals and drugs.

LYME REGIS CEMENT, LIME, STONE AND BRICK.—Registered 28th ult., with a capital of £25,000 in £5 shares, to acquire the interest of George Haycroft Esq., in the Lyme Regis Blue Lias Hydraulic Lime, Cement and Stone Quarries, in the county of Dorset, with property appertaining thereto.

MARGATE AND RAMSGATE EXCURSION AND TUG FLEET.—This company proposes to carry into effect an unregistered agreement of the 18th ult., between John Ibbetson Spier, of 8, Manor Road, Forest Hill, and Ralph Henry Dixon, of 127, Bridge Street, Battersea. It also proposes to carry on the business of steamboat and tug owners and of caterers for steamboat excursion traffic. It was registered 2nd inst., with a capital of £50,000 in £1 shares.

NETTLEFOLDS.—This company was registered 20th ult., with a capital of £750,000 in £10 shares, to acquire the manufactories, places of business, collieries, and works of Messrs. Nettlefolds, at Heath Street, Smethwick, Broad Street, Attwood's Passage, Princip Street, Birmingham; at Kings Norton, Worcester; and at Hadley and Ketley Somerset. Also to acquire the manufactory and works of the Birmingham Screw Company (Limited), and of the Manchester Steel Screw Company (Limited), and the manufactory and works of Mr. John Cornforth, at Berkeley Street, Birmingham, and the works of Messrs. Lloyd and Harrison, at Southport. The businesses to be carried on by the company are as follows:—Screw manufacturers, wire drawers and workers of metal, steel manufacturers, iron-founders, brass-founders, metallurgists, and producers of metal and alloys of all descriptions.

NICHOLLS, HAYNES AND COMPANY.—This is the conversion to a company of the business of engineers and tramway contractors, carried on by the above firm, at 41 and 42, Parliament Street. It was registered the 2nd inst., with a capital of £50,000 in £100 shares.

STUART IRON, STEEL AND TIN PLATE.—This company proposes to acquire the ironworks and premises, portions of Coedcal Furnace, Tyr Gwn Back, and other lands situate at Herwain, in the counties of Glamorgan and Brecon, part of which was lately occupied by the Welsh Iron Works Company (Limited). The company was registered on the 28th ult., with a capital of £50,000 in £100 shares.

WILLIAM ARNOLD AND GARSIDE.—This is the conversion to a company of the business of railway rolling stock manufacturers, carried on by the above firm at the Cliff Vale Waggon Works, Stoke-upon-Trent. It was registered 24th ult., with a capital of £50,000 in £5 shares.

PARTNERSHIPS DISSOLVED.

T. Mossop and H. Barber, Burslem, stone masons.—Shallett, Dale and Co., Fenchurch Street, ship brokers; as far as regards L. Walter.—Henson and Bradbury, Hartshead, near Halifax, contractors.—S. and G. Nuttall and Co., Rowley Regis, Staffordshire, coalmasters.—Tunstall Colliery Company, Tunstall, Staffordshire, coalmasters; as far as regards M. Scragg.—Shepard Brothers, Newport, Isle of Wight, and elsewhere, shipowners; as far as regards H. and J. W. Shepard.—Fitch and S. E. Cozens, Phœnix Wharf, Clink Street, Southwark; St. Saviour's Wharf, Rotherhithe, and other places, wharfingers.—Albion Ironworks Company, Rugeley, Staffordshire, agricultural engineers.—Pick and Baker, Bedford, agricultural engineers.—Marfell, Best and Co., wharf coal department, Great Western Railway.—W. I. Jones and Son, Birmingham, brass-founders.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

(Metal Market, City, Thursday Afternoon, 4 P.M.,

(*March* 11, 1880.)

METALS AND ORES.

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
COPPER (per ton)—				
Chili, for 90 per cent.	68 15/	—	68 5/	68 15/
Wallaroo	81 10/	—	81 0/	—
Burra Burra	80 0/	80 10/	80 0/	80 10/
English Tough	76 0/	78 0/	75 0/	—
English Ingot best..........	78 0/	79 0/	77 0/	—
Sheets sheathing and rod ...	81 0/	82 0/	80 0/	81 0/
Bottoms	86 0/	—	84 0/	—
Ore per unit	0 14/	0 14 6	0 14/	0 14 6
PHOSPHOR BRONZE				
Special Bearing Metal (p tn)	119 0/	—	116 0/	—
Other alloys (per ton	120 0/	142 0/	123 0/	139 0/
TIN (per ton)—				
Straits (Cash)........	89 0/	—	90 0/	—
Do. for arr..........	—	—	—	—
Billiton........	—	—	—	—
Banca	—	—	—	—
English Ingots	96 0/	—	94 0/	96 0/
Do. Bars	97 0/	—	95 0/	97 0/
Do. Refined	99 0/	—	97 0/	—
Australian	89 0/	—	90 0/	—
TIN PLATES, per box, I.C. coke f.o.b. London........	0 28/	0 30/	0 27/	0 30/
IX. do.	0 33/	0 35/	0 32/	0 35/
I.C. charcoal	0 31/	0 35/	0 30/	0 36/
I.X „	0 37/	0 41/	0 36/	0 40/

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
Lead (per ton)—				
Soft English pig	18 12/6	—	18 7/6	10 0/
Do. W.B.	—	—	—	—
Spanish soft	18 2/6	—	18 0/	—
Do. with silver	—	—	—	—
Sheet milled	19 10/	—	19 5/	—
Red lead	20 10/	—	20 10/	—
White	24 0/	—	24 0/	—
Patent shot	21 10/	—	21 10/	—
Zinc (per ton)—from No. 9 Gauge.				
Sheets, rolled	24 0/	—	24 0/	—
Do., foreign	25 0/	—	25 0/	—
Spelter (per ton)—				
Silesian, com	21 10/	—	21 0/	21 5/
Rhenish	—	—	—	—
English	—	—	—	—
Quicksilver, bot.	7 10/	—	7 0/	—
Antimony ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	71 0/	—	71 0/	72 0/
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 3/	—	0 3/	—
Brass (per lb.)—				
Sheets, 48 × 24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8½	—	0 0/8½	—
Yellow metal	0 0/6½	—	0 0/6½	—
Asbestos (per lb.)	0 0/3	0 0/6½	0 0/3	0 0/6½
Plumbago (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	March 4.		March 11.	
Iron, per ton (at works)*—	£ s.	£ s.	£ s.	£ s.
Bars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common	8 0/	—	8 0/	—
Do. Best	8 10/	9 0/	8 10/	9 0/
Sheets, singles, Cleveland	10 5/	10 10/	10 5/	10 10/
Staffordshire	11 0/	11 10/	11 0/	11 10/
Do. doubles, Staffordshire	12 10/	13 0/	12 10/	13 0/
Do. Lattens, Staffordshire	14 0/	14 10/	14 0/	14 10/
Plates, Ship, Stafford.	10 0/	10 5/	10 0/	10 5/
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	11 0/	11 10/	11 0/	11 10/
Hoops, Stafford	8 15/	9 5/	9 10/	10 0/
Nail Rods, Stafford	9 0/	—	9 0/	—
Swedish in Lond.	13 0/	—	13 0/	—
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 5/	6 10/	6 5/	6 10/
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow				
Scotch warrants..	3 2/9	—	3 1/9	—
Do. No. 1	3 7/6	4 0/	3 3/6	3 17/6
Cleveland, Tyne or Tees	3 2/	3 9/	3 2/	3 9/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
Swedish Iron—				
f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	13 0/	13 10/	13 0/	13 10/
Do. hammered	13 10/	14 0/	13 10/	14 0/
Billets	13 10/	—	13 10/	—
Horse Nail Rods	—	—	—	—
Belgian Iron—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	Nominal.			
Best				
Best Best				
Hammered				
Puddled Steel				
Bessemer				
Hoops				
Rails				
Rolled Girders				
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	16 0/	—
Milan	—	—	18 0/	19 0/
Bessemer rails	—	—	10 5/	10 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14/6	—	0 14/6	—
Do. 7 to 8	0 15/	0 15/3	0 15/	0 15/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 „ 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 „ 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 „ 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 „ 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 30lb short of an English ton.

OILS, CHEMICALS, &c.

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
Oils (per tun)—				
Olive, Malaga	—	—	—	—
Do. Gioja	45 0/	—	45 0/	—
Do. Levant	40 10/	41 0/	40 10/	41 0/
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	45 0/	46 0/	45 0/	46 0/
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	70 0/	71 0/	71 0/	72 0/
Cod	26 10/	27 0/	26 10/	27 0/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	30 15/	—
Do. brown	28 10/	—	28 10/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	33 10/	34 0/	33 10/	34 0/
Palm nut oil	34 0/	35 0/	34 0/	35 0/
Linseed oil	27 5/	—	27 5/	—
Cotton seed oil	27 10/	28 10/	27 10/	28 10/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	37 0/	39 0/	37 0/	39 0/
Do. Ceylon	34 0/	—	33 10/	33 15/
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Lndn.	11 0/	11 5/	11 0/	—
American bls.	10 5/	—	10 5/	—
Do. bags	10 12/6	—	10 12/6	—
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	6 0/	7 10/	6 0/	7 10/
Tallow—PYC.	43 0/	—	43 0/	—
S.Americn. Beef	41 0/	—	41 0/	—
Do. Sheep	38 6/	—	38 6/	—
Australian Beef	34 6/	36 0/	34 6/	36 0/
Do. Sheep	36 6/	38 0/	36 6/	38 0/
Rough Town Fat	14 0/	—	14 0/	—
Petroleum—				
Fine (per gal.)	0 0/6	—	0 0/5¾	—
Do. spirit	0 0/7	0 0/7¾	0 0/7	0 0/7¾
Turpentine—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
Whalefins (per. ton)—				
Davis' Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	1000 0/	1000 0/	1000 0/
Southern	500 0/	—	500 0/	—
Brimstone (per ton)—				
Rough, 2ds lnd.	7 0/	—	7 0/	—
Do. 3rds, do	5 10/	—	5 10/	—
Roll	8 15/	9 10/	8 15/	9 10/
Sulphur, Flour	10 15/	12 0/	10 15/	12 0/
Acid, (per lb.)				
Acetic, fine	0 0/4	—	0 0/4	—
Do. common	—	—	0 0/3	0 0/3¾
Citric	0 2/11	—	0 2/10½	—
Muriatic fine (per cwt.)	0 4/	0 6/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0/4¼	—	0 0/4¼	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/1	—	0 0/1	—
Do. Brown	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Tartaric Crystal	0 1/8	—	0 1/8	0 1/8½
Do. Pulv.	0 1/8	—	0 1/7½	—
Ammonia—				
Carbonate, per lb.	0 0/6½	—	0 0/6½	0 0/6¾
Sulphate, White & grey (per ton)	19 10/	—	19 10/	—
Arsenic—White Lump (per ton)	24 0/	—	24 0/	—
Powdered, do	11 3/	—	11 3/	—
Bleaching powder	0 8/9	—	0 8/9	—
Borax, Rfd., do.	3 2/6	—	3 5/	3 7/6
Copperas (ton)	2 10/	—	2 10/	3 5/
Bi-Sulphide Carbon (per ton)	24 10/	26 0/	24 10/	26 0/
Portland Cement—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk	0 9/	—	0 9/	—
Do. in sks, 200lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
Lead (per cwt.)—				
Acetate,...best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per ton)	20 6/	—	1 3/	—
White	1 4/	—	1 4/	—
Litharge (pr cwt.)	1 1/	1 2/	1 1/	1 2/
Lime (per ton)—				
Acetate, Grey, 85 %	19 0/	—	19 0/	—
Do. Brown 70%	14 0/	—	14 0/	—
Potash—				
Bichromate (lb.)	0 0/7	—	0 0/6¾	0 0/7
Chlorate (pr.lb.)	0 0/7½	—	0 0/7½	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1/11	—	0 1/11	—
Do. Yel. lb.	0 0/11¼	0 1/	0 0/11¼	0 1/
Sulphate, 80% (per ton)	14 0/	16 0/	14 0/	—
Saltpetre (per cwt.)—				
Engl. refnd. kgs.	1 7/6	—	1 7/6	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
Soda—				
Ash ... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 12/3	—	0 12/9	—
Caustic, 60 %	0 12/	0 14/6	0 12/	0 14/6
Do. 72 %	0 13/	—	0 13/	—
Nitrate	0 19/	0 19/6	0 19/	—
Crystals (per ton)	4 0/	—	4 0/	—

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

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THE BOARD OF TRADE RETURNS

Of the exports of iron, steel, and other metals, with coal, coke, and patent fuel, from the United Kingdom during the month of February, 1879, as compared with that of 1880. Also the exports for the month of February 1880.

Articles, and to what Countries Exported.	Feb., 1879.	Feb., 1880.	2 months. 1880.
IRON—Pig.	Tons.	Tons.	Tons.
To Russia	55	430	506
Germany	7,248	6,630	10,775
Holland	18,364	9,169	19,558
Belgium	6,593	16,362	32,073
France	8,719	6,958	14,859
United States	3,102	69,651	126,221
British N. America	20	1,310	1,510
Other countries	7,447	6,358	13,331
Total	51,553	116,868	219,433
Bar, Angle, Bolt and Rod.			
To Russia	120	181	604
Germany	196	242	701
Holland	238	302	415
France	6	11	33
Italy	588	707	1,901
Turkey	234	837	2,252
United States	32	6,526	13,345
British N. America	645	1,665	4,162
„ India	1,876	3,051	7,739
Australia	1,268	2,208	4,665
Other countries	5,727	8,006	16,275
Total	10,930	23,736	52,093
Railroad, of all Sorts.			
To Russia	—	64	64
Sweden & Norway	1,312	100	226
Denmark	5	—	1
Germany	—	—	—
Holland	—	—	—
Spain and Canaries	1,815	687	1,896
Italy	143	352	1,735
Turkey	19	—	—
Egypt	1,173	2,035	2,926
United States	737	12,842	28,169
Brazil	3,661	2,018	4,356
Peru...	263	348	447
Chili...	25	319	329
British N. America	167	—	1,085
„ Possessions in S. Africa	214	1,470	1,748
„ India	12,529	6,872	21,358
Australia	2,892	4,028	6,973
Other countries	3,126	4,842	9,448
Total	28,081	35,983	82,761
Wire of Iron or Steel (except Telegraph Wire)	2,251	5,742	10,438
Hoops, Sheets, & Plates			
To Russia	281	475	986
Germany	361	443	765
Holland	697	523	1,077
France	98	65	163
Spain and Canaries	278	515	968
Italy...	512	968	2,108
United States	36	4,957	9,942
British N. America	291	805	1,433
„ India	2,078	2,544	5,026
Australia	1,716	2,860	6,170
Other countries	3,991	5,456	12,023
Total	10,340	19,651	40,591
Tin Plates.			
To France	257	118	474
United States	9,117	10,257	27,270
British N. America	221	934	1,514
Australia	173	78	212
Other countries	2,009	1,324	2,910
Total	11,797	12,711	32,380
Cast or Wrought Iron (except Ordnance).			
To Russia	113	219	493
Germany	398	446	851
Holland	260	608	1,160
France	252	508	1,132
Spain and Canaries	783	532	932
United States	204	716	1,773
Peru	41	3	122
Brazil	1,603	2,030	3,026
British N. America	382	496	1,096
„ Possessions in S. Africa	759	717	2,101
„ India	4,380	2,168	7,262
Australia	3,424	2,040	5,923
Other countries	3,359	3,749	7,505
Total	15,958	14,241	33,496
Old Iron (for re-manufacture).			
To United States	381	29,529	54,501
Other countries	1,021	231	3,501
Total	1,402	29,760	58,002
STEEL, Unwrought.			
To France	254	324	546
United States	307	2,908	5,500
Other countries	1,025	1,412	3,056
Total	1,586	4,644	9,102
Manufactures of Steel	743	916	1,935
Total of Iron & Steel...	134,641	264,252	540,231
HARDWARE and CUTLERY.	£	£	£
To Russia	4,018	3,285	8,992
Germany	10,589	11,399	21,762
Holland	6,034	5,960	12,632
France	8,935	11,860	22,106
Spain and Canaries	5,064	5,892	15,430
United States	23,750	34,891	74,089
Spanish West India Islands	7,349	4,517	9,142
Brazil	8,893	22,474	47,411
Argentine Republic	3,825	4,723	8,902
British N. America	5,765	7,187	14,922
„ Possessions in S. Africa	13,623	14,595	28,505
„ India	16,612	23,606	53,064
Australia	39,546	29,022	52,521
Other countries	47,938	40,302	110,251
Total	201,941	22 ,713	480,329
MACHINERY AND MILL-WORK.			
Steam Engines.	£	£	£
To Russia	2,561	4,275	13,456
Germany	6,194	7,951	14,002
Holland	2,475	2,449	5,448
Belgium	1,802	1,107	1,937
France	4,363	4,147	13,330
Spain and Canaries	1,046	2,593	27,821
Italy	6,307	11,154	15,202
Egypt	1,451	1,925	3,228
United States	1,130	610	930
Brazil	6,035	9,454	13,703
British India	26,340	49,381	91,080
Australia	16,820*	16,387	43,824
Other countries	29,421	59,207	100,343
Total	105,945	170,9 0	351,004

ARTICLES, AND TO WHAT COUNTRIES EXPORTED	Feb., 1879.	Feb., 1880.	2 months, 1880.
OTHER DESCRIPTIONS.	£	£	£
To Russia	10,621	38,873	87,344
Germany	44,741	41,161	86,158
Holland	13,983	11,097	23,132
Belgium	12,467	14,012	31,080
France	33,328	32,212	71,087
Spain and Canaries	18,483	15,902	38,410
Italy	4,405	11,670	31,399
Egypt	2,958	7,635	14,516
United States	7,264	39,850	65,194
Brazil	8,790	10,911	22,326
British India	32,520	33,701	61,705
Australia	36,950	13,889	31,284
Other countries	53,628	45,931	110,081
Total	285,470	317,844	673,725
BRASS, MANUFACTURES OF (not being ordnance)	Cwt. 6,621	Cwt. 2,766	Cwt. 7,698
COPPER, UNWROUGHT			
To Germany	4,584	2,652	4,023
Holland	3,354	3,039	5,031
Belgium	1,892	1,991	3,468
France	9,851	15,138	20,121
British India	1,020	—	—
Other countries	1,423	12,059	14,395
Total	22,124	34,789	47,038
WROUGHT.			
To Russia	1,008	544	1,084
Germany	1,289	1,043	1,937
Holland	733	610	1,077
France	1,204	164	247
Italy	492	115	530
Turkey	3,652	2,151	4,015
Egypt	395	1,169	3,737
British India	6,866	9,847	21,226
Other countries	4,713	4,441	11,860
Total	20,352	20,684	46,613
MIXED OR YELLOW METAL SHEATHING	23,166	27,042	50,829
Total Copper	65,642	82,515	144,480
LEAD.	Tons.	Tons.	Tons.
To Russia	10	65	72
Germany	56	66	101
France	176	53	103
United States	46	10	70
China and Hong Kong	639	647	1,564
British India	207	203	359
Australia	259	75	148
Other countries	525	620	1,167
Total	1,898	1,739	3,584
TELEGRAPHIC WIRE AND APPARATUS	£ 24,685	£ 54,302	£ 86,115
TIN, UNWROUGHT.	Cwt.	Cwt.	Cwt.
To Russia	130	300	540
Germany	999	413	1,422
France	2,245	1,448	5,404
Turkey	22	46	220
United States	3,664	2,327	5,038
Other countries	2,329	1,287	2,617
Total	9,389	5,821	15,241
ZINC OR SPELTER	4,239	16,150	28,127
COAL, COKE, CINDERS, AND PATENT FUEL.	Tons.	Tons.	Tons.
To Russia	10,192	32,148	49,679
Sweden & Norway	28,119	58,072	104,603
Denmark	15,475	39,753	97,658
Germany	45,259	67,401	147,310
Holland	13,448	17,723	40,601
France	274,355	354,730	785,489
Spain and Canaries	64,785	77,625	156,175
Italy	82,307	121,729	239,570
Turkey	17,911	20,795	48,870
Egypt	59,538	52,957	118,805
Brazil	23,245	25,047	49,758
Malta	20,331	26,852	71,160
British India	42,816	65,841	137,194
Other countries	235,839	269,492	553,413
Total	933,750	1,230,765	2,530,554
COAL, &c., for steamers engaged in foreign trade	281,227	299,275	697,590

EXPORTS OF FOREIGN AND COLONIAL METALS AND ORE

FOR the month of February, 1880, as compared with the corresponding month of 1879. Also the foreign exports for the two months of 1880 as compared with 1879.

ARTICLES.	QUANTITIES. Feb., 1879.	Feb., 1880.	Feb., 1879.	2 Mnths., 1880.
Copper, unwrought or part wrought	Tons. 1,324	Tons. 1,787	Tons. 2,075	Tons. 2,822
Iron and Steel:—				
Iron: Bar	1,550	4,368	4,226	11,568
Steel: Unwrought	16	410	101	687
Quicksilver	lb. 170,107	lb. 55,513	lb. 366,145	lb. 150,060
Tin, in blocks, ingots, bars, or slabs, and regulus	cwt. 11,107	cwt. 17,359	cwt. 23,254	cwt. 36,077

ARTICLES.	VALUE. Feb., 1879.	Feb., 1880.	Feb., 1879.	2 Mnths., 1880.
Copper, unwrought or part wrought	£ 79,737	£ 131,639	£ 126,240	£ 208,113
Iron and Steel:—				
Iron: Bar	11,405	39,777	35,370	109,859
Steel: Unwrought	260	4,078	1,158	7,336
Quicksilver	14,737	5,089	31,284	13,902
Tin, in blocks, ingots, bars, or slabs, and regulus	33,908	82,417	72,086	159,452

THE quantity and value of iron and coal exported during February, 1880, compared with the same month of 1879.

YEARS.		Quantity.	Value.
IRON	1880	Tons. 264,252	£ 1,989,972
	1879	134,641	1,054,302
	Increase	129,611	£935,670
	Decrease	—	—
COAL	1880	Tons. 1,230,765	£ 571,310
	1879	933,750	428,558
	Increase	252,410	£142,752
	Decrease	—	—

IRON EXPORTS.

COMPARATIVE exports of pig, merchant, and railway iron for the last twelve months.

PORT.	1879. March.	1879. April.	1879. May.	1879. June.	1879. July.	1879. Aug.	1879. Sept.	1879. Oct.	1879. Nov.	1879. Dec.	1880. Jan.	1880. Feb.
(PIG IRON.)	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Ardrossan	615	590	1,885	196	965	2,280	1,850	5,510	2,606	555	[illegible]	4,281
Borrowstoness	—	180	335	200	102	—	—	—	—	—	—	—
Cardiff	250	278	750	10	7	208	60	1,103	300	700	950	110
Charlestown	—	—	30	—	15	—	—	—	—	—	—	—
Glasgow	7,804	10,153	8,237	5,504	6,912	8,432	16,786	21,129	16,185	12,314	13,895	10,755
Goole	100	—	100	—	—	—	—	156	94	—	—	—
Grangemouth	7,267	11,083	10,955	1,524	2,460	2,110	2,870	3,447	1,285	320	960	1,084
Granton	50	30	—	10	30	—	9	—	10	20	—	—
Greenock	797	108	10	—	175	180	2,490	6,009	—	60	200	—
Grimsby	160	130	72	16	20	35	50	5	—	—	250	—
Hartlepools	2,594	2,280	2,414	1,540	1,109	2,273	2,111	4,140	2,765	1,696	1,229	1,860
Hull	875	1,207	1,711	2,601	1,069	1,618	1,478	2,871	2,191	3,295	2,118	3,707
Liverpool	2,289	2,402	1,751	1,861	2,534	2,851	10,892	21,131	17,637	11,391	54,461	19,748
Middlesborough	41,771	38,911	44,167	25,449	20,652	31,288	40,691	48,528	31,723	1,086	32,380	38,532
Newcastle-on-Tyne	723	1,925	5,991	2,184	4,169	4,428	5,114	7,392	7,523	3,350	6,480	3,660
Newport	—	41	45	—	110	—	—	50	1,000	—	1,550	381
North Shields	—	—	—	—	400	322	—	230	66	—	—	—
Port Glasgow	—	—	—	—	—	—	200	—	—	—	—	—
South Shields	—	—	85	—	—	—	70	140	510	—	6	—
Sunderland	—	310	540	180	50	—	—	—	—	—	655	970
Swansea	—	—	4	—	20	—	—	—	—	20	—	252
Troon	150	780	550	310	2,250	400	20	—	3,850	200	1,620	40
Whitehaven	5,325	46,521	5,145	850	4,320	1,290	3,800	700	2,100	1,200	1,100	1,050
(MERCHANT IRON.)												
Ardrossan	—	—	—	6	—	—	—	—	—	—	—	—
Cardiff	1,159	2,616	2,445	—	823	3,560	936	1,299	2,016	2,708	263	982
Glasgow	311	1,524	997	592	723	954	619	883	776	716	1,435	14
Goole	—	11	—	—	—	—	—	—	—	—	—	—
Grangemouth	—	15	—	—	—	—	—	—	—	—	—	—
Greenock	7	—	—	—	—	—	14	—	—	—	—	—
Grimsby	11	26	10	33	15	5	8	4	5	50	—	—
Hartlepools	626	464	734	765	995	42	504	632	89	517	210	94
Hull	734	461	984	804	913	1,247	1,505	2,676	3,505	1,239	1,985	1,157
Llanelly	—	—	—	—	—	—	450	—	—	—	—	—
Liverpool	7,963	7,425	6,282	6,795	6,377	5,250	7,611	10,170	12,640	11,114	12,111	12,046
Middlesborough	2,945	3,073	5,154	4,022	3,486	775	1,095	943	1,913	517	37	56
Newcastle-on-Tyne	609	1,220	4,102	1,220	1,336	1,250	1,685	1,510	1,377	3,075	331	379
Newport	—	—	—	—	32	—	—	—	321	20	—	—
North Shields	—	—	439	124	13	—	—	10	—	—	—	—
Seaham	—	—	—	—	—	—	—	—	—	—	—	—
South Shields	17	21	90	1	47	29	58	187	189	5	80	—
Stockton	—	199	—	—	—	—	—	—	—	—	—	—
Sunderland	—	25	—	11	6	—	—	545	—	—	—	20
Swansea	169	—	—	—	385	936	922	39	1,016	52	240	80
(RAILS.)												
Ardrossan	—	—	—	—	—	—	—	—	1,000	940	—	—
Cardiff	4,355	7,120	3,427	4,532	5,351	10,174	11,380	10,192	6,007	7,043	12,005	9,503
Glasgow	—	—	—	—	503	900	1,536	—	3,504	704	640	82
Greenock	—	—	—	—	—	700	—	—	—	—	—	—
Grimsby	—	—	—	—	—	—	410	687	1,005	410	1,000	—
Hartlepools	—	—	50	—	—	—	—	—	—	450	—	—
Hull	561	484	37	1,285	7	9	157	827	1,315	—	1,594	354
Liverpool	4,265	2,018	5,621	8,420	8,642	7,440	8,492	9,116	12,580	8,950	11,732	6,654
Middlesborough	2,011	2,314	2,950	4,358	2,105	1,065	1,684	2,031	1,733	450	2,600	500
Newcastle-on-Tyne	—	—	3	4	1,171	42	—	3	—	255	—	—
Newport	2,546	3,433	5,501	4,691	10,686	5,013	8,758	3,222	4,206	5,803	7,237	6,895
Port Glasgow	—	—	—	—	—	—	—	—	503	—	—	—
South Shields	—	—	10	—	—	—	—	—	100	—	—	—
Sunderland	—	—	—	—	—	—	—	—	—	1,070	—	—
Swansea	—	—	10	—	—	1344	—	733	346	688	608	—
Troon	—	—	—	—	—	—	480	6,000	—	—		—

COAL AND COKE EXPORTS

To foreign parts from the principal English ports in the months of February, 1879 and 1880, and for the whole year 1879.

PORT.	Coal. Feb., 1879.	Coke. Feb., 1879.	Coal. Feb., 1880.	Coke. Feb., 1880.	Coal. 12 months 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Alloa	4,306	—	8,338	—	159,699
Amble	4,473	—	7,356	—	76,504
Ardrossan	1,450	—	1,372	—	62,970
Ayr	—	—	654	—	7,944
Blyth	6,178	—	8,800	—	190,557
Borrowstoness	893	—	265	—	32,849
Cardiff	337,553	746	390,851	2,637	4,253,678
Charlestown	4, 01	—	8,600	—	184,514
Dundee	844	—	3,090	—	66,125
Glasgow	14,755	172	17,092	106	244,786
Goole	16,864	—	24,798	—	255,640
Grangemouth	5,769	50	3,674	—	118,768
Granton	9,365	—	3,288	—	120,436
Greenock	6,938	—	3,134	—	119,231
Grimsby	9,314	—	11,425	—	257,016
Hartlepools	13,525	208	28,573	1,500	517,258
Hull	18,359	282	29,409	50	412,368
Irvine	—	—	558	—	4,787
Liverpool	32,278	117	35,340	493	552,181
Llanelly	2,306	—	5,509	—	71,127
Middlesboro'	2,282	334	2,259	1,679	28,515
Newcastle	177,340	11,502	230,031	14,854	3,751,794
Newport	57,163	90	75,485	573	938,012
North Shields	14,520	—	25,937	—	226,348
Port Glasgow	800	—	1,280	—	10,619
St. David's	755	—	909	—	54,907
Seaham	235	—	3,004	—	35,374
South Shields	12,836	—	22,418	—	358,711
Sunderland	59,391	105	72,009	580	1,015,928
Swansea	48,915	83	59,341	645	676,419
Troon	9,130	—	8,074	—	104,189
Whitehaven	—	—	—	—	309

SHIPPED for English ports from the undermentioned, in the months of February, 1879 and 1880 and for the whole year 1879.

PORT.	Coal. Feb., 1879.	Coke. Feb., 1879.	Coal. Feb., 1880.	Coke. Feb., 1880.	Coal. 12 months 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Alloa	613	—	275	—	15,392
Amble	6,493	—	7,950	—	91,360
Ardrossan	15,852	—	18,006	—	221,554
Ayr	34,856	—	29,311	—	354,570
Blyth	1,428	—	1,087	—	43,597
Borrowstoness	2,103	—	1,186	—	30,542
Cardiff	67,679	—	55,628	—	826,044
Charlestown	970	—	518	—	11,376
Dundee	244	—	285	—	2,091
Goole	8,462	—	7,158	—	87,008
Granton	8,762	—	4,838	—	65,972
Grimsby	1,393	—	876	—	38,399
Hartlepools	51,513	50	47,313	—	607,393
Hull	1,009	—	2,289	—	51,260
Irvine	7,478	—	8,222	—	102,189
Liverpool	35,775	—	34,126	150	478,059
Llanelly	6,032	—	6,072	—	116,383
Middlesboro'	3,941	95	4,527	—	46,053
Newcastle	224,102	22	224,559	480	2,586,646
Newport	87,076	—	63,786	—	983,558
North Shields	—	—	350	—	729
St. David's	90	—	330	—	872
Seaham	30,408	—	45,440	—	558,809
South Shields	25,626	—	27,558	—	238,770
Stockton	—	—	309	—	1,222
Sunderland	192,555	—	173,704	—	2,091,559
Swansea	40,116	45	45,885	—	543,207
Troon	25,150	—	28,079	—	291,448
Whitehaven	16,300	—	14,087	—	217,545

IRON AND STEEL RAIL EXPORTS

During the month of Feb., 1880, as compared with Feb. 1879; also for first two months of 1879 and 1880. The Board of Trade make the usual reservation as to accuracy.

	QUANTITIES Month ended Feb. 1879	1880	Two months ending Feb. 1879.	1880.
IRON RAILS:—	Tons.	Tons.	Tons.	Tons.
To Russia	—	—	—	—
Sweden and Norway	4	—	6	—
Germany	—	—	—	—
Spain	110	100	791	303
Italy	136	317	146	480
United States	301	6,608	301	14,549
Brazil	126	66	276	90
Chili	85	—	36	10
British North America	—	—	100	45
British India	823	338	1,210	1,567
Australia	318	474	2,156	633
Other Countries	805	928	2,101	2,307
Total	2,648	8,841	7,123	19,984
STEEL RAILS:—				
To Russia	—	—	—	—
Sweden and Norway	1,237	101	3,537	220
Germany	—	—	187	—
Spain	1,669	147	2,574	1,025
Italy	—	—	—	918
United States	436	6,162	506	13,512
Brazil	2,314	1,581	3,502	3,685
Chili	—	286	477	286
British North America	167	—	450	1,015
British India	6,036	4,840	7,409	17,854
Australia	2,168	3,030	6,365	4,789
Other Countries	3,635	5,339	4,266	7,098
Total	18,262	21,486	29,173	50,402
TOTAL OF IRON AND STEEL RAILS	20,910	30,327	36,296	70,386

	VALUE			
IRON RAILS:—	£	£	£	£
To Russia	—	—	—	—
Sweden and Norway	29	—	42	—
Germany	—	—	—	—
Spain	740	600	4,485	2,019
Italy	680	1,585	747	2,360
United States	1,505	39,829	1,505	81,340
Brazil	704	565	1,570	705
Chili	155	—	230	83
British North America	—	—	545	339
British India	5,438	2,802	7,768	11,901
Australia	1,583	3,312	11,015	4,274
Other Countries	5,511	5,774	12,808	13,443
Total	16,345	54,467	40,775	116,624
STEEL RAILS:—				
To Russia	—	—	—	—
Sweden and Norway	8,659	605	24,386	1,216
Germany	—	—	1,440	—
Spain	9,053	837	15,222	6,855
Italy	—	—	—	4,595
United States	3,480	40,630	3,980	86,873
Brazil	19,029	9,163	23,127	20,839
Chili	—	2,287	3,339	2,287
British North America	1,087	—	3,228	7,207
British India	37,773	27,247	45,910	100,069
Australia	13,735	17,110	38,020	27,341
Other Countries	21,168	40,222	25,799	51,042
Total	174,014	138,077	184,458	309,121
TOTAL OF IRON AND STEEL RAILS	130,359	192,544	225,226	425,745

No Application for Shares will be received after Thursday, the 18th March, for London, and the following day for the Conntry.

ASSOCIATED MINEOWNERS, LIMITED.

Incorporated under the Companies' Act, 1862; the LIABILITY *of each Shareholder being* LIMITED *to the amount* UNPAID *on his Shares.*

CAPITAL £300,000, IN 30,000 SHARES OF £10 EACH.

Subscriptions are Invited for a First Issue of 15,000 A Shares, with a Redeemable Preference, both as to Dividends (10 per cent.) and Capital, Payable £1 on Application and £4 on Allotment,

And the remaining £5 in Calls, not exceeding £1 each, at Intervals of not less than Two Months, and on One Month's Notice.

Board of Direction.

The RIGHT HON. the EARL OF ONSLOW, Chairman.
THOS. J. BEWICK, Esq., M.E., M. Inst. C.E., Haydon Bridge, Northumberland, Chairman, Bewick and Partners (Limited).
LT.-COL. FRANK BOLTON, 19, Grosvenor Gardens, S.W., Director, Bewick and Partners (Limited).
A. FORRESTER BROWN, Esq. (Parry and Co., Madras), 53, Gloucester Terrace, Hyde Park, Director, Southern India Alpha Gold Mining Company (Limited).
JOSEPH DODDS, Esq., M.P., D.L., Stockton-on-Tees, Chairman, Darlington Iron Company (Limited).
H. A. FOWLER, Esq., Whittington Hall, Derbyshire, Director of the Bilbao Iron Ore Company (Limited).
MATTHEW GRAY, Esq., Assoc. M. Inst. C.E. (Silvertown), Blackheath.
JOHN HICK, Esq., M.P., Mytton Hall, Lancashire.
JOHN JOICEY, Esq., J.P., D.L., Stocksfield-on-Tyne, Director, Bewick and Partners (Limited).
W. BARROW SIMONDS, Esq., M.P., Abbot's Barton, near Winchester.
EDWARD WOODS, Esq., M.Inst.C.E., Westminster, Director, Bilbao Iron Ore Company (Limited).

Managing Director of Works.

T. SOPWITH, Esq., C. & M.E., M. Inst. C.E., 6, Great George Street, S.W.

Bankers.

THE IMPERIAL BANK (LIMITED), Lothbury, E.C., and Westminster Branch, Victoria Street, S.W.

Consulting Engineers.

T. W. CRAWHALL, Esq., M.E., Alston, Cumberland.
J. DARLINGTON, Esq., C. & M.E., 2, Coleman Street Buildings, E.C.

Auditors.

MESSRS. DELOITTE, DEVER, GRIFFITHS, & CO., No. 4, Lothbury, E.C.

Solicitors.

MESSRS. FOWLER & CO., 3, Victoria Street, S.W.
MESSRS. GADSDEN & TREHERNE, 28, Bedford Row, W.C

Agents at Swansea—

MESSRS. RICHARDSON & CO., Copper re Wharves.

Secretary (*pro tem.*)—

P. SCRATCHLEY, M.A.

Registered Office—

No. 4, Broad Sanctuary, London, S.W.

ABRIDGED PROSPECTUS.

I.—OBJECTS.

Mining Enterprise, when confined to one venture only, is necessarily of an uncertain and speculative character. This Association has been founded by Mineowners who are the holders of Shares and Debentures of several Mining Companies, to secure the advantages of unification, concentration of management and average investments, and also to extend and strengthen their operations by the introduction of further capital.

II.—DEVELOPMENT OF THE INDIAN GOLD FIELDS.

The development of the valuable Gold Fields of India, especially those of the Wynaad District in the Madras Presidency, is now attracting much general interest. The Southern India Alpha Gold Mining Company (Limited) (registered under "The Indian Companies Act, 1866"), was formed in 1874, and, as its name applies, was the pioneer Company in working the Gold Fields of the Wynaad. It is this Property that the Indian Government caused to be specially inspected by Mr. R. Brough Smyth, whose full Reports to the Government, together with other particulars connected with this Gold Field are also published in the Appendix to the Prospectus (page i.), to which the attention of intending subscribers to the Association is requested. The Alpha Mine has already been partially opened out, and its mineral resources consequently ascertained to a certain extent, at an expenditure of about £14,000. The Capital of the Alpha Company has lately been increased, in order to carry out the recommendations of the Government Inspector, from 1 lac to 6 lacs of rupees (£60,000), in 12,000 Shares of 50 rupees each; and this Association has secured the option of subscribing *at par* for 7200 of these new Shares, being all that remain to be placed. The Alpha Company have also secured the co-operation of the Foreign and Colonial Tunnelling and Prospecting Company (Limited), of which the Right Hon. Lyon Playfair, M.P., is Chairman), for the rapid prospecting, proper development, and subsequent working of the mine on the plan recommended by Mr. Brough Smyth, by means of the Prospecting Company's Diamond Rock-Boring and other special apparatus. The Prospecting Company, in addition to providing a skilled staff and organisation at cost price, bring many other advantages to bear on these mining operations, as they possess the exclusive right for India to a patented chemical process of treating gold and silver ores, which enables much of the precious metal to be saved that is lost under the ordinary processes. Moreover the Prospecting Company's remuneration is made entirely dependent upon profitable results being obtained. There appears, therefore, to be every reason to anticipate that the interest in the property which can thus be acquired would be a valuable source of profit to the Association.

The Reports, Deeds, and Documents relating to the Alpha Company, and samples and assays of the gold and ores can be seen at the Offices of the Association.

DEVELOPMENT OF OTHER PROPERTIES.

Arrangements are being entered into by the Association to acquire the Shares of the undermentioned Companies for an agreed number of fully-paid B or Ordinary (Deferred) Shares. The Debentures will be acquired and paid for either in cash or A Shares, or partly in cash and partly in A Shares, as the Directors of the Association may determine. Algerian Mineral Company (Limited), Ain-Barbar. Argentiferous Copper and Zinc Mine. In Algeria. Anglo-Behemian Coal Company (Limited), Lana Colliery of Black Coal. In Bohemia. Argentière Mineral Company (Limited), Argentière. Silver-Lead Mine. In France. French Mineral Company (Limited), Ispagnac. Silver-Lead Mine. In France. Odivellas Mineral Company (Limited), Segura. Silver-Lead Mine. In Portugal. Venda Do Duque. Copper Mine. In Portugal.

Full description and particulars of the above Companies and Properties are contained in the Reports published by the Associotion in the Appendix issued with the Prospectus. The Mines are proposed to be taken over and worked by the Association as from the 1st January, 1880.

III.—CAPITAL.

Of the 30,000 Shares of the nominal Capital, Subscriptions are now invited for the first issue of 15,000 A Shares, having a Redeemable Preference in respect of Dividend of 10 per cent. (cumulative) per annum, and in the repayment of Capital.

IV.—DISTRIBUTION OF PROFITS.

The Net Profits each year will be applied as follows:—

(i.) In payment of a Cumulative Dividend of 10 per cent. upon the A Shares.

(ii.) In payment of a Cumulative Dividend of 10 per cent. per annum on the B Shares.

(iii.) Of the remaining Net Profits, one-half will be applied in the formation of a Bonus Fund to be distributed amongst the A Shares, for the purpose of Redeeming their Preference; and the remaining half will be set aside to a Reserve Fund.

The A. Shares will constitute a first charge upon the profits and assets of the undertaking, as against the B Shares, until their Preference has been redeemed.

V.—PROSPECTS.

Intending investors are referred to the Reports, which will enable them to form their own opinion as to the value of the properties taken over; but the Directors believe that there is every reason to anticipate satisfactory profits from the undertaking.

As an instance of the profitable results that are obtained in Mining the Langley Barony Lead Mines in Northumberland (known as Bewick and Partners, Limited) may be mentioned, in which some of the Board of this Association are Directors. These mines were worked for several years before any results were obtained; since then, in a period of four consecutive years (to April, 1879), on the original paid-up capital of £24,000, the total net profits, notwithstanding the depression in the price of Lead, have been nearly £54,000, or 225 per cent. in four years' working.

VI.—PRELIMINARY EXPENSES AND DIRECTORS' REMUNERATION.

No promotion money will be paid, and the preliminary expenses will be confined to the actual amount required for the formation of the Association, the Brokers' Commission being limited to 2s. per £10 Share.

The remuneration of the Directors will be two guineas each (with two guineas additional to the Chairman) for every Board Meeting attended by them.

VII.—DOCUMENTS.

Copies of the Memorandum and Articles of Association, and Reports, Plans and Sections of all the Mines and Works, can be inspected at the Offices of the Company.

Applications for Shares to be forwarded to the Company, at the London Offices, or to the Bankers, together with remittance for the Deposit of £1 per Share on the number of Shares applied for.

Prospectuses, with the appended Reports, can be obtained at the Bankers, Solicitors, Consulting Engineers, and the Offices of the Company.

Should no Allotment be made, the Deposit will be returned in full.

OFFICES:—4, Broad Sanctuary, Westminster, S.W.

ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

RATES of freight on iron cargoes remain steady, but most of the business done has been for sailing vessels, as steamers are asking rates out of proportion to those accepted by sailers.

Steamers.—Part cargoes of iron have been fixed from lower Swedish ports to London at 10s. and 11s. per ton, and one has been chartered from Taganrog to the United States at 40s. per ton, to load old rails on the opening of the navigation, and another has accepted 10s. per ton for a cargo of ore from Lisbon to the Tees.

Sailing vessels have been fixed from London to San Francisco at 24s. per ton old rails, and from Middlesborough to New York or Philadelphia at 16s. 6d. per ton pig-iron, and Middlesborough to Riga Town at 7s. 6d. per ton pig-iron and coke. For a vessel of 600 tons burthen a lump sum of £400 has been paid from Amsterdam to a United States port for a cargo of iron, and from Gothenburg to New York or Philadelphia 15s. 6d. per ton to load old rails has been done.

London, March 10th, 1880.

JAMES H. WEAGER AND CO.'S METAL REPORT.

THE tone of the metal market has been somewhat capricious the last week. Opening somewhat flat, holders of second-hand parcels of some descriptions became scared, and evinced strong desires to realise. This feature was particularly noticeable in the pig-iron market which dropped from 62s. 6d. to 58s. 6d., in consequence of large quantities forced for sale. The price, however, soon rallied, and the market closes with buyers at 61s. 6d. Manufactured iron in fair demand, Staffordshire bars obtainable at £8 10s. for the cheaper makes. Copper is quieter, prices generally easier, as at foot. Tin, after falling to £88 and £88 10s. for foreign, we have to report a stronger market. There are buyers at £90; English ingots, £94 to £96. Lead remains flat. Holders of secondhand parcels seem wisely inclined now to put them by, rather than depreciate the market. We attach our present prices. Tin plates: Needy makers are quoting low prices, but we think there is no fear of a big relapse, although consumers, who are not always conspicuous for enlivening anticipations of the future, talk the contrary. Our present prices are:—Iron: Bars, Staffordshire, £8 10s. to £8 15s. per ton; hoops, £9 10s.; sheets, £10 to £11 per ton. Copper: English ingots and blocks, £70 per ton; sheets, sheathing, and rods, £80; yellow metal sheets and sheathing, £6 10s. per ton. Tin: English ingots and blocks, £94 per ton; bars, 4 cwt. barrels, £95; foreign, Straits, £90; Australian, £90 per ton. Tin plates: Cokes, £27 per ton; charcoals, £30 per ton. Lead: Spanish pig, £18 per ton; English pig, £18 7s. 6d.; bars, £18 15s.; pipe, £19; sheets, £19 per ton. Zinc, £24 per ton. Spelter, £21 per ton. Antimony, £71 per ton. Quicksilver, £7 per bottle.

JAMES H. WEAGER AND CO.

26, Leadenhall Street, E.C.

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

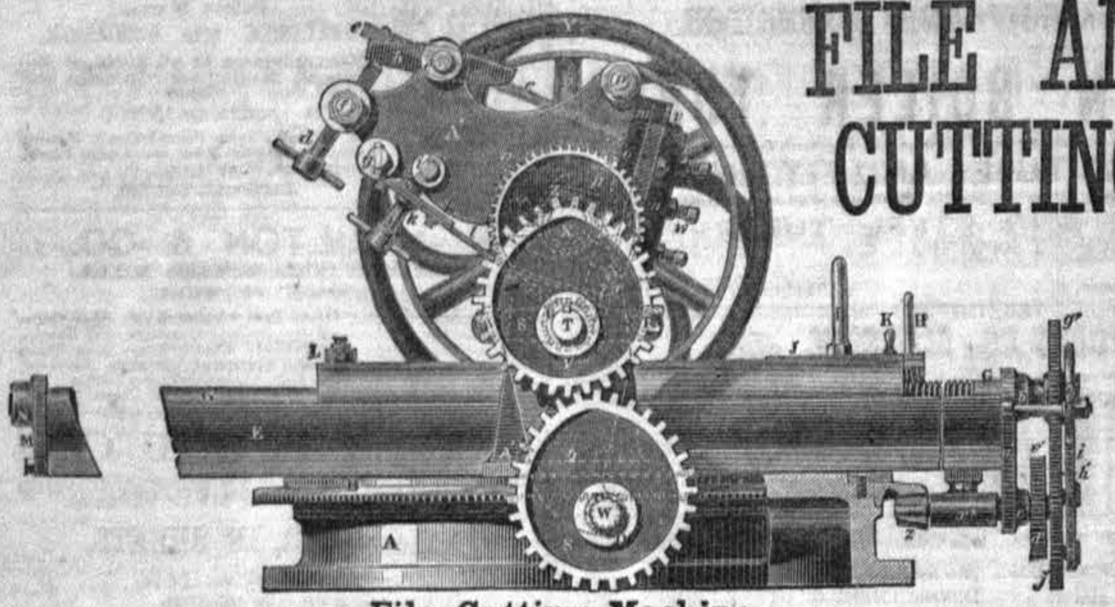
Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather double nailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ⅝ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ⅝ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ¼ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ⅝ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 65 to 67½%; end Best solid tower, 60 to 65½%; solid end barrel brass knob, 60 to 62½%; japanned Scotch tower bolts, 45 to 50%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/0 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /9½ to /10½ per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /9¾ to /10¾ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11¼ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5. **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10¾ to /11½ per lb.; Brass **Escutcheon pins**, ⅜ by 16 inch, W.G., /10½ to 1/. **Brass jelly pans**, with bails, 1/ to 1/1; without bails, 1/1 to 1/2 per lb. **Maslin kettles**, cast, 4 to 16 inch, /10½ to 1/ per lb. **Pinpoints**, 1/4 to 1/5. Brass **Rivets** for boots, 12 to 17, W.G., /10 to /11 per lb. Brass **Shoe Bills**, 1/1½ to 1/2½ per lb. Brass **Scale pans**, 2/ to 2/2; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅜ inch and above, /10½ to /11¼ per lb. Locomotive and marine boiler tubes, seam less from 1⅛ to 4 inch outside diameter, to 14, W.G., /8¾ to /9¼.

Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/5 to 1/6 per lb.; Copper **Wire**, 0 to 20 W.G., /10½ to /11. **Brass cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings** 1/ to 1/6 per gross; **Cornice poles**, 2¾ inch, brass best burnished 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2¾ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¼ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¾ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 42½ to 47½%; double link, iron, 37½ to 47½%; single link, brass, 37½ to 47½%; registered double link, brass, 32½ to 37½%; close link brass Chain, 5 to 10% brass oval lamp Chain, 22½ to 27½%; brass Clock Chain, 22½ to 27½%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6; japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/ **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/ close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅜ inch hook at each end, 19/ to 20/ backbands, 19/6 to 20/6; short link Chain, plain or twisted, ⅜ inch, 18/ to 20/; ½ inch, 16/ to 18/; 1 inch, 14 to 16/ per cwt.; Cart and plough traces, 21/ to 23/ per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55%, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 50%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 45%; Common, 70%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal,

FOR SALE OR BUSINESS ARRANGEMENT.

FILE AND RASP CUTTING MACHINES.



File Cutting Machine.

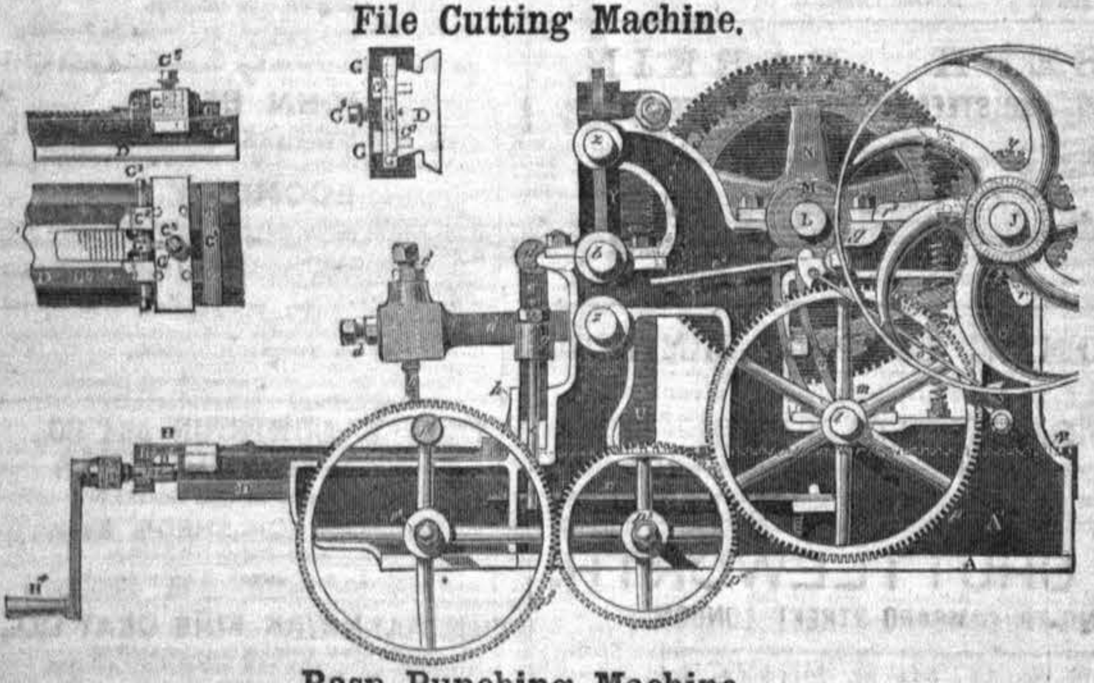
THE

PATENT RIGHTS

OF THESE

MACHINES,

Taken out in January, 1878, are now offered.



Rasp Punching Machine.

FOR FULL

Illustrated Description, see "*IRON,*"

November 7th, 1879.

FURTHER PARTICULARS GIVEN, AND ARRANGEMENTS MADE TO SHOW THE MACHINES IN OPERATION, BY

T. W. LEE,

2, Pancras Lane, Queen Victoria Street, London, E.C.

50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 45 to 50% common, 52 to 57½%; kitchen **Fireirons**, in sets, /6 to /7 per lb.; tongs only, /6½ to /7; pokers only, /5½ to /6 per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/. Cut wire **Fencing staples**, 0 to 6, 22/ to 24/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 61½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 5½ to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs, two prongs**, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 62½%; strong, 40 to 50%; patent Scotch butts, 52½ to 55%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 52½%; extra strong bed hinges, 42½ to 55%; patent chest, 45 to 47½%; patent strap, 45 to 55%. **H Hinges**, 40 to 55%; HL hinges, 40 to 55%; japanned and garnett hinges, double washered, light and strong, 35 to 40%; best best patent London or Lancashire tees, 52½ to 60%; patent light japanned Scotch Tees, 55 to 62½%; light patent hooks and hinges on plate and to drive, 20 to 25%; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned, Tees double washered, 20/6 to 23/6; Gothic Scotch japanned, Tees 21/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/. **Wrought hinges**, common and best, 35 to 40%; best best, 30 to 35%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 26/ per cwt.; **Lancashire hinges** wrought, 30 to 35%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net **horseshoes**, fullered fore, 18/ to 20/; fullered hind, 19/ to 21/; stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. **Hollowware**, 45 to 50%; common to best, enamelled, 20 to 25%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 11/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 9/6 to 10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 9/6 to 10/6; cart bushes, 11/6 to 13/6; camp ovens, 10/ to 11/; cooking stoves, 12/6 to 13/6; cogs for blocks, 17/ to 19/; cellar grating, 10/6 to 12/6; clock weights, 9/ to 11/; Dutch stoves, 11/ to 13/; dumb bells, common, 9/ to 11/; best best japanned, 19/ to 21/; frying pans, cast handles, 12/6 to 14/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4; galvanised furnaces up to fifty gallons, /9 to 1/ per gallon; furnace doors, 12/ to 14/; furnace grates, 9/6 to 11/6; forge backs, 12/6 to 13/6; heaters for box irons, 8/6 to 10/6; heaters for urns, 10/ to 11/; jack wheels, 18/ to 20/; oven doors and frames, 12/ to 14/; pots, three legged, Danish, plumbers', and Nego, 10/ to 12/; plumb bobs, 13/6 to 15/6; pudding pans, 13/6 to 15/; pump spouts, 14/ to 16/; sash weights, 8/6 to 9/6 ditto, with pulleys, 11/ to 13/; shoe anvils, 11/6 to 12/6; slippers 12/6 to 13/6; **Italian irons**, 35 to 50%.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; **keys and banks**, 50 to 55%; extra strong plate, 30 to 32½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter **knobs**, 52½ to 57½%; brass cupboard turns, 52½ to 57½%; brass drawer knobs, 52½ to 57½%; brass ash pan knobs, 52½ to 57½%; brass range knobs, 35 to 40%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 60½ to % 62½; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, best, 55 to 65% common **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned struck **ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Oddwork, tinned and black, 15 to 20%, list; **Paris pointes**, best English, 15/6 to 16/; foreign, 18/ to 20/; **planes**, 25 to 30%; iron **axle pulleys**, 1¾ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass escutcheon **pins**, ⅜ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ⅜ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ⅜ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ⅜ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 40 to 50%; strong, 30 to 35%; Lancashire plate locks, 25 to 30%; pewter measures, 25 to 30%.

Riddles, 30 to 35%; **Rivets**, iron boot rivets, /3½ to /4 per lb. patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ¼ inch, 23/ to 24/; ⅜ inch, 18/ to 19/; ½ inch, 17/ to 18/; ¾ inch, 16/ to 17/. Delivered in London or Liverpool; machine-made wire Rivets, ⅜ inch, 14/6 to 15/6 per cwt.

Rakes, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 50%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates**, I C, 30/ to 32/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ⅜ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brazed tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 60 to 62½%; fittings, 62½ to 65%; iron **Water Tubes**, 50 to 52½%; fittings, 52½ to 55%; iron **Steam Tubes**, 45 to 47½%; fittings, 47½ to 50%; galvanised iron gas Tubes, 45 to 47½%; fittings, 47½ to 50%; lap-welded **Boiler Tubes**, 47½ to 50%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 32/ to 34/ per cwt.; common bright, 40/ to 42/ per cwt.; black staples vices, solid box black, 42 to 48/; bright, 41/ to 47/; solid box, black staple, with spherical washer, 40/ to 45/; bright 41/ to 55/.

Washers, light iron, 70%; heavy washers, 13 to 16 lb., W.G., 12/6 to 14/ per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvansed oval, 22 inch, 19/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 14/6 to 15/6 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No. 18, 4/ to 4/3 per stone 14 lb.; cut tinned bottling wire, No. 22, 4/11 to 5/6 per stone 14 lb.; weaving and binding wire, No. 23, 4/ to 4/2 per stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone 14 lb. net; cast steel wire, 0 to 6, /9½ per lb.; 10 to 20%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¼ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 2¼ inch diameter, /½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 14/6 to 15/ per cwt.; annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to 6, round or oval 16/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6 per cwt.; galvanised rolled, 1 to 4, 14/9 to 15/9 per cwt.

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J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

CHEMICALS.—The course of business during the week has, like that of its predecessor, rather tended to weakness. Enquiries have been less plentiful, not only those of a *bona fide* character, but likewise those which are frequently made to test the position, have been absent. This argues an opinion amongst consumers that the zenith of the improvement has been passed, and that operations are to be restricted to the smallest possible parcels. As the generality of prices are decidedly easier for buyers, it should have the effect of bringing them on the market; but this has certainly not been the case during the week, the tendency being the other way. As yet it is impossible to say how the future months are likely to be employed) Manufacturers are well sold forward, but a rather lessened demand from America creates apprehension and uneasiness in some minds which we do not think is fully justified. We are more inclined to believe the present quietness as a reaction from the sustained excitement of some months past, and which will only continue until prices find a working level. Alkali and sodas have been in more moderate request, and surplus quantities are being pushed at slight concessions to buyers. Bleaching powder is in more plentiful supply, principally through increased production. rather than a decrease of demand. Acids are firm and scarce, with the exception of oxalic, which is a shade easier. Nitrates are unchanged. Metallic salts receive a moderate share of attention only. Acetates of lime and lead are offering more freely. Arsenic has a ready sale at full rates.

MINERALS.—As was the case last week, prices have rather remained stationary than otherwise, the fluctuations being slight and uninteresting. A large trade continues to be done in almost every class of mineral, and if the increase has not been as marked during the week as hitherto, it is satisfactory to observe that no falling off is reported. The demand for iron ore is freely sustained, and buyers are pushing for supplies, notwithstanding the enormous quantities being raised, both at home and abroad. All descriptions sell freely, and holders of the better classes obtain their terms without any difficulty. Brimstone is rather firm, particularly for small parcels. Manufactured sulphurs are unchanged, though makers quote higher. China clays are in better demand, though the increase in this respect is by no means great. Ochres if anything receive less attention.

METALS.—The condition of highly-stringed sensitiveness which exists between our pig-iron trade and that of America has been well illustrated during the week. The reports from that country some ten days or a fortnight ago urged the probability that the heavy buying could not be much longer maintained, and these, having been followed by an immediate falling off in the magnitude of the orders, has had a depressing influence on some brands, particularly those of Glasgow, which have receded to 62s. 6d. at the time we write, or a decrease of 7s. 6d. per ton below last week's prices. Yet, strange to say, each decrease has induced some heavy transactions by home houses, thus ventilating their opinion that the weakness is only temporary. Hematitet also have receded about 10s. per ton—a rather large fall considering the hitherto extremely firm position of these qualities. A portion of this, however, may be debited to the increase of production. Middlesborough brands have not been able to resist the depressing influence of the Glasgow market, and prices have declined some 2s. per ton. No. 3 is freely offered at 61s. per ton for prompt delivery, and the same figure is accepted for delivery over the ensuing two or three months, whereas last week merchants were asking and obtaining 2s. 6d. per ton for the latter delivery over prompt. Lancashire makers nominally hold out for an advance of 2s. 6d. per ton, but we have not heard of their success in this. Derbyshire and Lincolnshire iron is tolerably steady. Copper and Tin are both easier—the former by about £1 and the latter £2 per ton. Lead is also easier, at £8 15s. per ton for English, Spelter, on the contrary, keeps firm.

GENERAL ITEMS.—It is computed that since the advance in iron, the London and North-Western Railway Company have made a profit of £250,000 on old permanent way materials. During 1879 America exported 765,130,493 dollars worth of merchandise, against 737,092,073 dollars in 1878. The imports were valued at 513,780,016, and 431,812,483, dollars, respectively.

While it is acknowledged that Mr. J. B. Hannay has succeeded in producing diamonds, the cost of the artificial over the natural gem is some 2000 per cent.

Manchester, March 6th, 1880.

THE RAILROAD OUTLOOK.—*The Iron Age*, in an elaborate and careful examination of the prospect for railway building in the United States in 1880, reaches the conclusion that indications point to the construction of about 7000 miles of new road, rather more than fewer, and that the demand during the year for new rails, to be used for new roads and old tracks, will reach 1,500,000 gross tons, of which the American mills can supply, under favourable circumstances, not more than 1,400,000 tons, leaving 100,000 tons to be imported.

AMERICAN RAILWAYS.—During the past year the increase of mileage of new railways was greater than in any year since 1873. The new lines constructed in 1878 were 2916; but this was largely exceeded in 1879, in which 4430 miles were built, which makes the total mileage of the States 86,263, nearly one-half of the entire mileage of the world. Of the last year's extensions, 923 miles, or less than 21 per cent., were of narrow gauge, while in the preceding year 30 per cent. were built on this gauge. The tide of railway activity is almost entirely turning west of the Mississippi. The Eastern States have covered their districts with networks of lines, and with the exception of short feeders and connections between old-established systems there is no railway construction going on worth notice, and, indeed, there is scarcely room for it. In the whole of New

GOLD MEDAL, PARIS, 1878.

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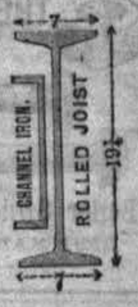
6 × 6	3 × 3	3 × 1½ = 5 „	5 × 4½ = 23 „	7 × 3½ = 20 „	9½ × 4½ = 29 „	12 × 6 = 56 „	4 × 4½	9½ × 3½
6 × 3½	2½ × 2½	4 × 1½ = 7 „	6 × 2 = 11 „	8 × 4 = 22 „	10 × 4½ = 32 „	14 × 6 = 60 „	5 × 3	9¼ × 3¼
5 × 3½	2 × 2	4 × 3 = 12 „	6 × 3 = 16 „	8 × 5 = 29 „	10 × 5 = 36 „	16 × 6 = 62 „	3 × 3	8 × 3¼
4 × 3	1½ × 1½	5 × 2 = 8 „	6 × 5 = 29 „	8 × 6 = 34 „	10 × 6 = 54 „	18 × 6½ = 82 „	2½ × 2½	6 × 2½
4 × 4	1 × 1					19½ × 7 = 100 „	2 × 2	4½ × 2½
							1½ × 1½	2½ × 1
							1 × 1	

JOISTS—Lengths, from 6 to 30 ft. PLATES—Width, 6" to 18"; Length, 12 to 30 ft.; Thickness, ¼" to ¾".



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CRUCIBLE STEEL CASTINGS.

LANGLEY MILL, near NOTTINGHAM.

England the new mileage during 1879 was only 42, and the same may be said of Ohio and the adjoining States. But it was very different in the group of States lying in the north-west and in the basin of the Mississippi, where great railway activity has been shown. In Kansas alone 544 miles were constructed last year, in Iowa 472, in Minnesota 451, in Nebraska 285; while Illinois, Missouri, Wisconsin, and Dakota ran up the total to 3187 out of the 4430 miles. There were 1243 miles built in the States east of the Mississippi in 1879, against 3187 west of that river, and the cost of railway construction advanced nearly 30 per cent. during the year, with prices still tending upwards. Among the principal lines now in progress are the Sioux City and Nebraska, making a thorough route between Omaha and St. Paul; the Vicksburg, Shreveport, and Pacific, in the State of Louisiana; and the Atchison (Kansas) and Nebraska line.

IMPORTANT IMPROVEMENTS IN PILE-DRIVERS.

BRONZE MEDAL, PARIS, 1878.

LACOUR'S

Patent Direct-Acting Steam Pile Driver.

Used in the Principal Government Harbours, Docks, and Railways in France, Italy, and Spain.

Effects considerable saving in time and money in the operation of driving piles through hard or soft ground.

The winch is only used for placing the pile in position, the monkey being operated by steam direct from the boiler.

The monkey can be readily fitted to the frame of an ordinary Pile Driver.

SOLE LICENSEES and MANUFACTURERS for the United Kingdom of Great Britain,

S. OWENS AND CO.,

HYDRAULIC AND GENERAL ENGINEERS.

WHITEFRIARS STREET, LONDON, E.C.

Illustrated Pamphlet and Price List Free.

YOUNG'S PARAFFIN LIGHT & MINERAL OIL CO., LIMITED.

THE DIRECTORS of this Company are prepared to receive TENDERS for the supply of the GENERAL STORES required at their ADDIEWELL, BATHGATE and BIRMINGHAM WORKS, and also at all their Pits, for the YEAR ENDING 30TH APRIL, 1881, as under:—

Class No.
1. BOLTS, NUTS AND RIVETS.
45. BRASS, &C.
2. BRICKS, CLAY, &C.
4. CANDLE BOXES.
5. CANVAS.
6. CAST IRON CASTINGS.
7. CHEMICAL APPARATUS.
8. CLOTHS, PLAIDING, &C.
10. CORKS.
16. DRYSALTERIES.
17. GAS AND WATER FITTINGS.
18. GLASS CHIMNEYS.
19. GREASE, SOAP, AND TALLOW.
20. GUN METAL.
21. HARDWARE AND SUNDRIES.
22. INDIARUBBER, &C.

Class No.
44. JAPANNING AND BRONZING MATERIALS.
23. LAMP BURNERS, &C.
24. LAMP FOUNTS AND HAND LAMPS.
27. NAILS, SCREWS, &C.
32. REFLECTORS.
29. ROPES, &C.
30. SHADES, MOONS, &C.
31. SHIVES.
39. SHOVELS.
37. TIMBER.
33. TIN, LEAD, &C., FOR CHEMICAL WORKS.
46. TIN, LEAD, &C., FOR LAMP WORK.
40. TOOLS.
35. WICKS.
41. WIRE ROPES.

Detailed Specifications and Forms of Tender, and any other necessary information, may be obtained, on and after WEDNESDAY, 10th current, at the Company's Registered Office, 7, West George Street, Glasgow.

Patterns of the General Stores may be seen at the Company's Addiewell Works, near Westcalder; and Patterns o Lamp Fittings at their Lochrin Works, Edinburgh.

Tenders endorsed "TENDER FOR STORES," to be lodged with the undersigned on or before WEDNESDAY, 24th current.

The Directors do not bind themselves to accept the lowest or any offer.

JOHN FYFE, *General Manager.*

MERCHANTS' HOUSE BUILDINGS,
7, WEST GEORGE STREET, GLASGOW, 8th March, 1880.

PHOSPHOR BRONZE.

(BY ROYAL LETTERS PATENT.)

THE BEST METAL FOR

BEARINGS, SLIDE VALVES, PUMPS, STEAM FITTINGS, &c.

SUPPLIED IN INGOTS OR CASTINGS, WIRE, SHEETS, RODS, &c.

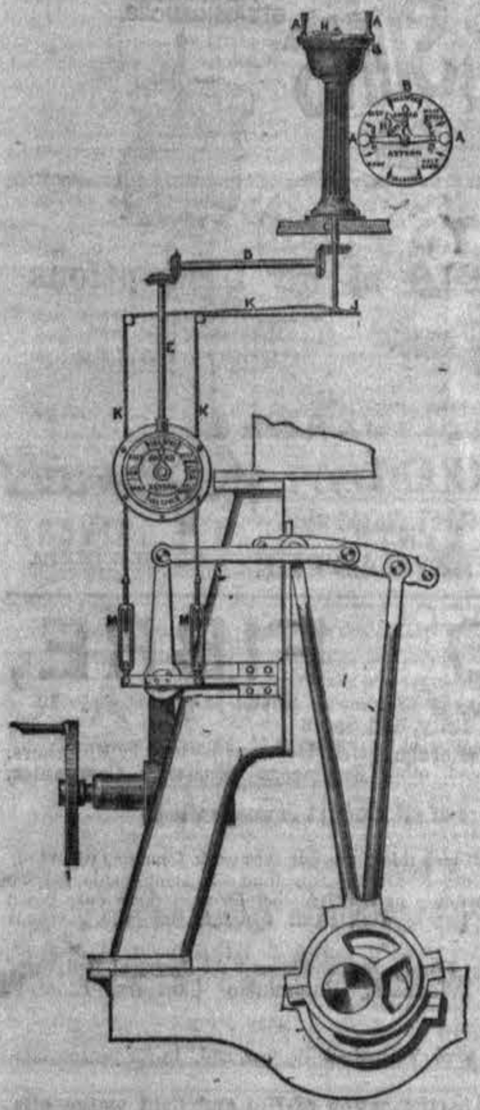
For Ingot Quotations, see Price List of Metals in this Paper

Sole Manufacturers,

THE PHOSPHOR BRONZE COMPANY, LIMITED,

10, SUMNER STREET, SOUTHWARK, LONDON, S.E.

COLMAN'S AUTOMATIC ENGINE-ROOM AND BRIDGE TELEGRAPH.



This is the only BRIDGE TELEGRAPH in which the Engine itself replies to the Captain's orders.

By Royal Letters Patent.

APPLY TO

JAMES CHRISTIE,

133, ST. VINCENT STREET,
GLASGOW;

JAMES P. THOL

18, MINCING LANE, E.C.;

OR TO

ARTHUR H. COLMAN,

NEWCASTLE-ON-TYNE.

COATBRIDGE TIN PLATE AND SHEET IRON WORKS.

COATBRIDGE, near GLASGOW.

Manufacturers of **COKE, BEST COKE, CHARCOAL AND BEST CHARCOAL TIN PLATES**

Charcoal.	Charcoal.	Trade Marks:	Coke.	Best Coke.
B 👑 B Coatbridge.	— Glasgow.		— Manx.	B AND B Anchor.

Also Manufacturers of SHEET IRON—Various Qualities,

COMMON, BEST, CHARCOAL, STRIP IRON, MAIL SHEET, &c.

The Coatbridge Tin Plate Company (Limited).

FORSYTH, MILLER, AND CO.,

BROAD STREET, MILE END, GLASGOW.

Improved Malleable Iron (or Steel) Castings.

HYDRAULIC CYLINDERS,

Spur Wheels and Pinions for Rolling Mills, and other Heavy Castings up to 6 Tons.

LONDON OFFICE:—

39, Tavistock Street, Covent Garden, W.C. GEORGE HATCH, Agent.

To which Small Patterns may be sent.

Agents for Sweden and Norway: Lander and Larrson, New Edmund Street, Birmingham. Agent for France: M. Tatin, 12, Rue de Malte, Paris.

HUNT & TAWELL,

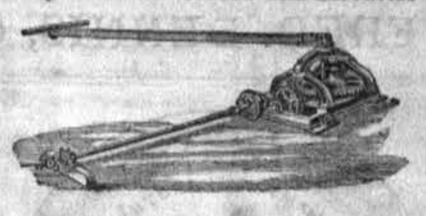
ATLAS WORKS,
EARLS COLNE, ESSEX,

Manufacturers of

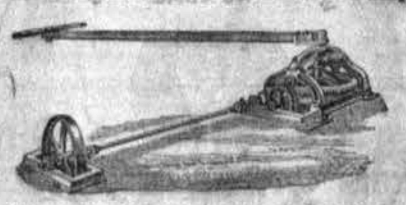
AGRICULTURAL IMPLEMENTS

Including

Pony Gears for Churns and Elevators.



Horse Gears for Chain and Barrel Pumps.



Horse Gears for Saw Benches and Cotton Gins.

Horse Gears for Thrashing Machines Chaff Cutters, &c.,

And fitted or 1, 2, 3, or 4 horses.

Sole Manufacturers of BIDDELL'S PATENT FOOD PREPARING MACHINERY, recently manufactured by Messrs. Ransomes, of Ipswich.

Prices and terms to Shippers, with cost of packing, quoted on application.

SCHÄFFER & BUDENBERG'S NEW INJECTOR.

This Injector possesses the following advantages:—

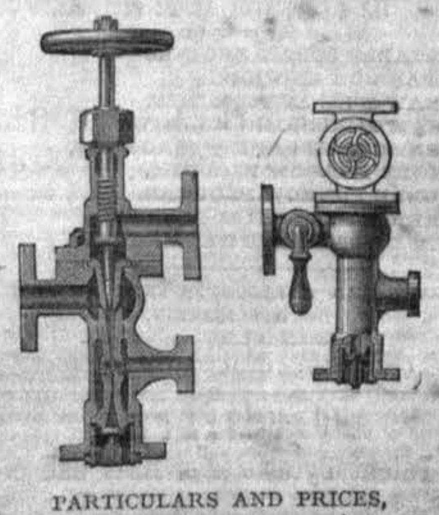
Great Simplicity,

CONSEQUENT DURABILITY,

NON-LIABILITY TO DERANGEMENT,

AND

CERTAINTY OF ACTION.



PARTICULARS AND PRICES,

1, SOUTHGATE, MANCHESTER.

THE HOWE WEIGHING MACHINES.

ADAPTED TO ALL STANDARDS.

For all Commercial, Manufacturing, Railway, Mining, and Household Uses, &c., &c., &c.

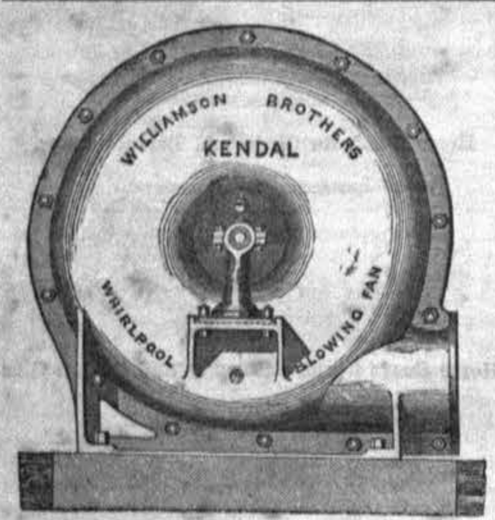
HIGHEST AWARDS AT PARIS, 1878.

OVER 600 SIZES AND STYLES, AND ALL GUARANTEED.

CATALOGUE ON APPLICATION IN ANY LANGUAGE.

FACTORY, RUTLAND, VERMONT, U.S.A.

J. FRED. DENNIS, General Manager, 8 & 9, Holborn Viaduct, London.



BLOWING FANS,

FOR CUPOLAS OR SMITHS' WORK.

These Fans are strong, well made, and require the least power to give any required blast.

CENTRIFUGAL PUMPS.

VORTEX TURBINES,

The best means of utilising water-power.

STEAM ENGINES, CORN MILL MACHINERY,

Illustrated price lists on application.

WILLIAMSON BROTHERS,

CANAL IRONWORKS,

KENDAL.

RANSOMES, SIMS AND HEAD,

ORWELL WORKS, IPSWICH, ENGLAND,

ENGINEERS AND MANUFACTURERS OF THE BEST

AGRICULTURAL MACHINERY,

ADAPTED

FOR ALL COUNTRIES, CROPS AND SOILS,

INCLUDING

PORTABLE STEAM ENGINES
EXPANSION ENGINES,
STRAW-BURNING ENGINES,
STEAM THRESHING MACHINES,
CORN SCREENS AND WINNOWERS,
SINGLE FURROW PLOUGHS,
DOUBLE FURROW PLOUGHS,
FOREIGN & COLONIAL PLOUGHS,
HORSE RAKES AND HAYMAKERS.

ILLUSTRATED CATALOGUES FREE BY POST ON APPLICATION.

London Office: 9, GRACECHURCH STREET.

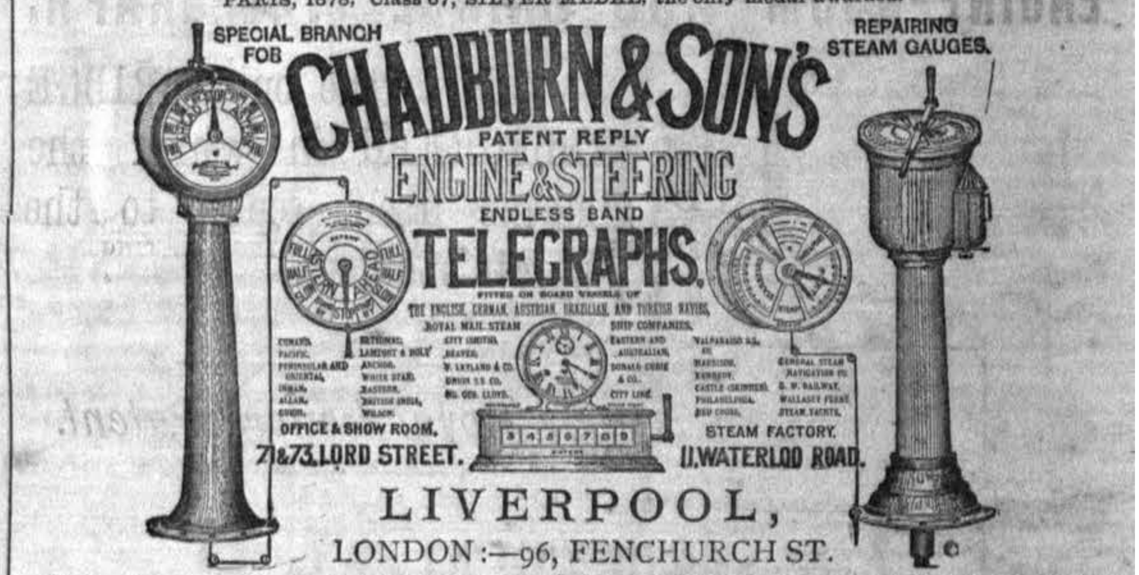
GAUNTLETT'S

Patent Pyrometer or Heat Gauge.

Recent improvements have rendered this Gauge extremely sensitive and durable. It is now made to register to 1500 deg. Fahrenheit. It is applied to Ovens, Heating Stoves, Boiler Flues, Heated Air, Hot Liquid Steam, Gases, &c. Testimonials on application.

W. H. GAUNTLETT, Middlesborough-on-Tees.

PARIS, 1878, Class 67, SILVER MEDAL, the only medal awarded.



SPECIAL BRANCH FOR REPAIRING STEAM GAUGES.

CHADBURN & SON'S

PATENT REPLY

ENGINE & STEERING

ENDLESS BAND

TELEGRAPHS,

FITTED ON BOARD VESSELS OF THE ENGLISH, GERMAN, AUSTRIAN, BRAZILIAN, AND TURKISH NAVIES, ROYAL MAIL STEAM SHIP COMPANIES,

Cunard, Pacific, Peninsular and Oriental, Inman, Allan, Guion, [illegible], Lamport & Holt, Anchor, White Star, Eastern, British India, Wilson, City (Smith's), Beaver, W. Leyland & Co., Union S.S. Co., No. Ger. Lloyd, Eastern and Australian, Donald Currie & Co., City Line, Valparaiso S.S. Co., Harrison, [illegible], Castle (Skinner), Philadelphia, Red Cross, General Steam Navigation Co., [illegible] Railway, Wallasey Ferry, Steam Yachts.

OFFICE & SHOW ROOM, 71 & 73, LORD STREET.

STEAM FACTORY, 11, WATERLOO ROAD.

LIVERPOOL,

LONDON:—96, FENCHURCH ST.

GLASGOW: 2, TAYLOR PLACE, GOVAN ROAD. | NEWCASTLE: 40, BLENHEIM STREET.

VULCANISED FIBRE,

PATENTED.

The FLEXIBLE is a Substitute for **Leather, Rubber, Gutta Percha,** &c., and is extensively used by **Plumbers, Brass Founders, Axle Makers, Hydraulic, Sanitary,** and other **Engineers Railway Companies; Carriage Builders, Pump Makers, &c.**

It makes the best insertion sheet, and for axle-washers of all kinds it is unequalled.

Mr. George Howe, Engineer at the Clay Cross Collieries, says:—

"That a pump clack faced with Vulcanised Fibre one half inch thick, was put into work January 13th, 1879, and was taken out July 3rd, 1879, having been in work 171 days. During this time the pump made 741,827 strokes, and raised 74,182,700 gallons. The clacks were previously used with leather facings; these only lasted in work about 40 days; when faced with gutta percha, they last in work about 150 days, but gutta percha is 5s. per lb., whereas the fibre is only 2s."

The HARD is a Substitute for **Metals, Ivory, Vulcanite, Ebony,** &c., and is used for **Journal Bearings and Bushes, Condenser Ferrules, Railway Fish-plate Washers, Pneumatic Carriers, Electric Machines, &c.**

Mr. T. A. Edison, the great electrician, writes:—

"I esteem it very highly, and use larger quantities of it than Vulcanised Rubber, and, in its present condition, find it very satisfactory."

Both qualities of the Vulcanised Fibre are uninjured by the action of Hot and Cold water, oils, spirits, grease, ammonia, and many other chemical agents which utterly destroy leather, metals and rubber.

Sold in sheets about 66 inches and 42 inches and varying in thickness from 1-32 to 1 inch.

SOLE AGENTS:—

MOSSES AND MITCHELL, 62, Queen Victoria Street, London, E.C.

CORPORATE MARK.

Granted according to Act of Parliament, 1777 by the Cutlers' Company, Sheffield.

TOOLS, STEELS, FILES,

R. MUSHET'S SPECIAL STEEL.

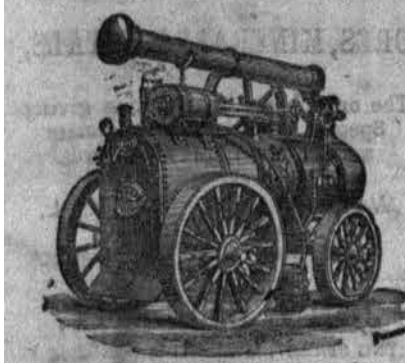
Railway Springs, Steel Castings, Shear and Spring Steel, &c., &c

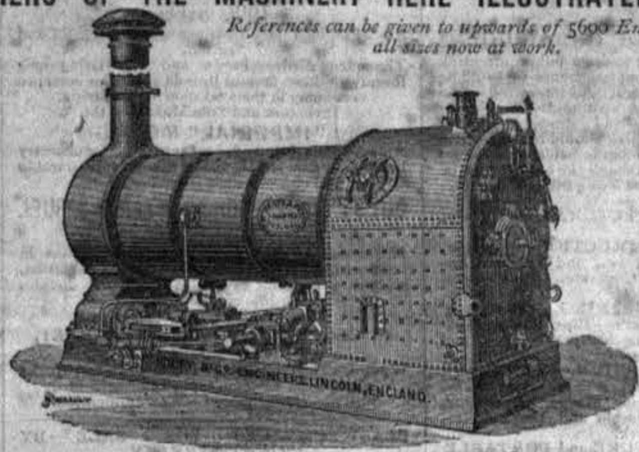
SAMUEL OSBORN AND CO,

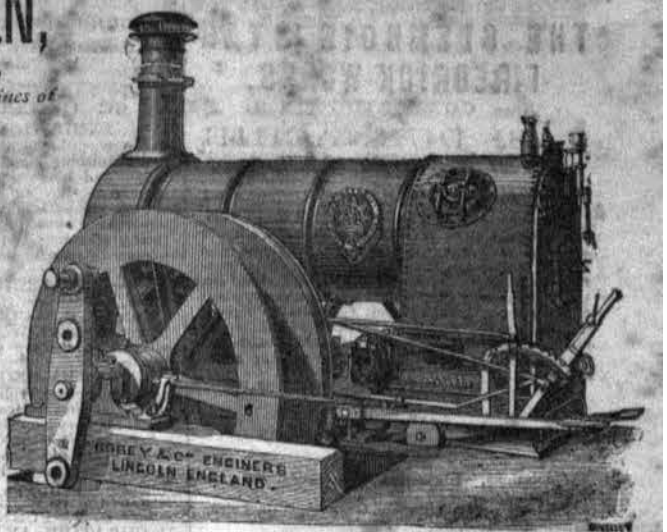
CLYDE STEEL AND IRON WORKS, SHEFFIELD.

LONDON: 16, Philpot Lane, E.C.; BOSTON (U.S.): 10, Oliver Street; MONTREAL: 470, St. Paul Street; BERLIN: 48, Neue Friedrichs Strasse.

ROBEY AND CO., ENGINEERS, LINCOLN,
SOLE MANUFACTURERS OF THE MACHINERY HERE ILLUSTRATED.
References can be given to upwards of 5690 Engines of all sizes now at work.

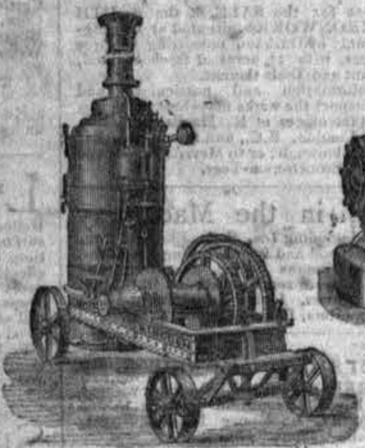

Superior Portable Engines, 4 to 50 h.-p.

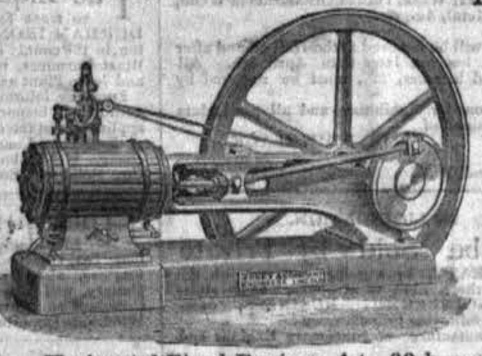

ROBEY & CO. ENGINEERS LINCOLN, ENGLAND
The Patent "Robey" Fixed Engine, 4 to 50 h.-p.



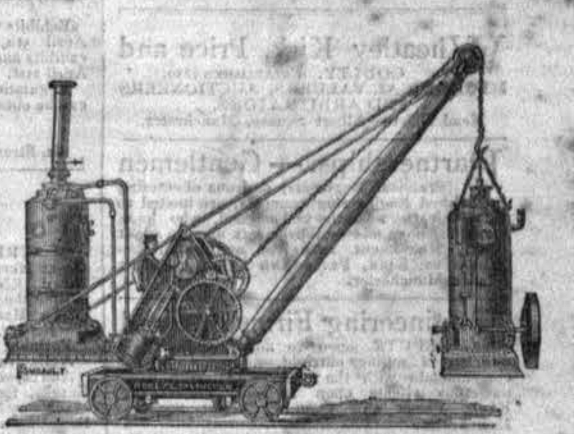
Patent "Robey" Mining Engine, 4 to 200 h.-p.

Vertical Engines, 1½ to 12 h.p.


Improved Steam Travelling Crane


Horizontal Fixed Engines, 4 to 60 h.-p.

ROBEY & CO.,
ENGINEERS,
LINCOLN, ENGLAND.
Catalogues, Prices and Photographs on Application.

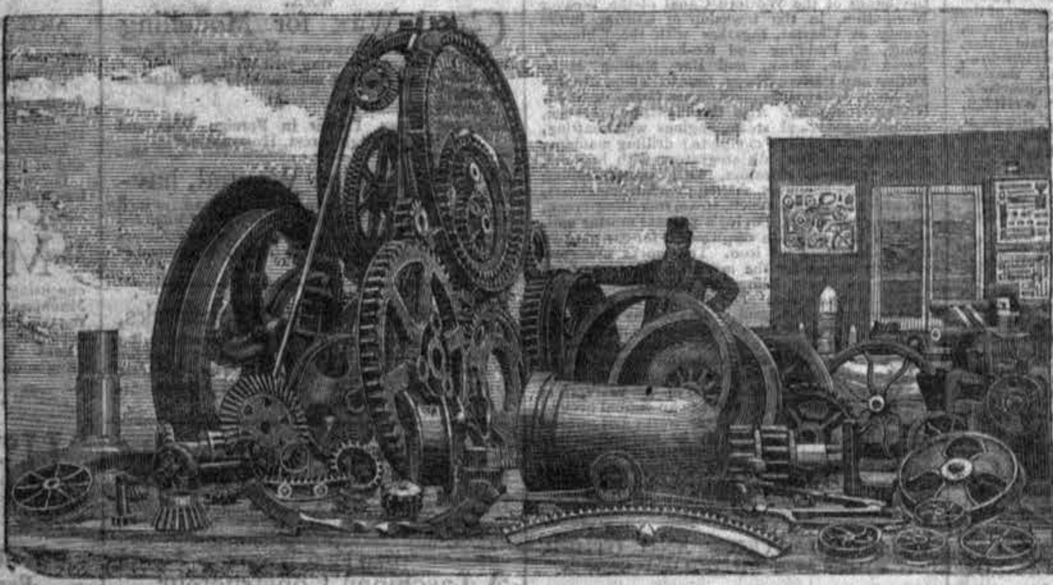

Improved Barrow Hoist.

JOHN SPENCER AND SONS,
Newburn Steel Works, Newcastle-on-Tyne.

STEEL CASTINGS

TRADE &S NEWBURN MARK.

ORIGINAL MANUFACTURERS OF
VOLUTE SPRINGS.
Best Cast Steel Files.



STEEL FORGINGS

TRADE S MARK.

RAILWAY
SPRINGS & BUFFERS.
Best Cast Steel or Tools.

GEORGE SALTER & CO., West Bromwich,
Manufacturers of SPRING BALANCES,
Roasting Jacks, Sad Irons,
Bourdon's, Schaeffer's and Silvester's
PRESSURE GAUGES
COLLIERY SIGNAL BELLS, RASTRICK'S TUBE SCRAPERS,
Conical, Spiral, & all kinds of Coiled Springs
MADE TO ORDER.

VALVE SPRING

SCHAEFFER GAUGE

COLLIERY BALANCE UP TO 1 TON

SILVESTERS PATENT SAD

CONICAL SPRING

NEW OLIVER SPRING

WIRE TESTER ANY PRESSURE UP TO 5 TONS

BOURDON GAUGE

LOOSE HANDLED SAD

VALVE SPRING

KELLY'S DOOR SPRING

RASTRICK'S PATENT SCRAPER

GOODS SUPPLIED THROUGH MERCHANTS AND FACTORS.

Two Silver Medals, Paris, 1878.
The Chilian Medal, Santiago, 1875.

THE GLENBOIG STAR FIREBRICK WORKS,

Near COATBRIDGE, N.B.

JAS. DUNNACHIE,
2, West Regent Street, Glasgow.

Contractor to Her Majesty's Government

Manufacturer of Fire Bricks for Steel, Iron, Brass, Gas, Chemical and Glass Furnaces, Copper roasting, calcining and refining furnaces. The special bricks for the Siemens regenerative gas-furnace (this is the brand recommended by Dr. C. W. Siemens). Bessemer tuyeres, runners, plugs and stoppers, Gorman tubes. Gannister of highest quality, ground fireclay. No other firebrick combines such a high degree of infusibility with the perfect absence of cracking and splitting up under sudden cooling.

Each brick bears the registered Trade Mark.

Trade J Star Works * Glenboig D Mark

Quotations, Illustrated Catalogues, &c., on application.

Shipping ports, Glasgow, Grangemouth, Leith, Granton, Boness, &c.

London Agents: Messrs. Doulton and Co., Lambeth Pottery, and Crown Wharf, Victoria Park, E.

Wheatley Kirk, Price and GOULTY. Established 1850.
MECHANICAL VALUERS, AUCTIONEERS AND ARBITRATORS.
Head Offices—Albert Square, Manchester.

Partnerships. — Gentlemen (Practical Engineers) desirous of entering established Engineering concerns, are invited to communicate with the undersigned, who have numerous bona fide establishments open to admit such. References are given and required.—Wheatley Kirk, Price and Goulty, Albert Square, Manchester.

Engineering Firms of Good REPUTE, open to admit partners, or desirous of selling outright, are requested to communicate with the undersigned, who have numerous clients open for such.—Wheatley Kirk, Price and Goulty, Albert Square, Manchester.

IN THE HIGH COURT OF JUSTICE, CHANCERY DIVISION.

IN THE MATTER OF THE COMPANIES ACT 1862 AND 1867,

AND

IN THE MATTER OF JACKSON, GILL AND Co. (LIMITED.)

To be Sold, pursuant to an Order of the High Court of Justice, made in this Liquidation, with the approbation of the Master of the Rolls, by Mr. Charles Willman, C.E., M.E., the person appointed by the said Judge, at the Board Room, Royal Exchange, Middlesbro', in the County of York, on TUESDAY, the 23rd day of March, 1880, at 12 o'clock at noon precisely, in one Lot, certain FREEHOLD IRON WORKS, known as the "Imperial Iron Works," situate at South Bank, near Middlesbro'-on-Tees, in the County of York, together with the Land, Fixed Plant, Buildings, Railways, Loose Plant and Tools, Brick Works, and also 20 Freehold Cottages occupied by Workmen employed at the said Iron-works. The Works are at present in full operation, and will be offered for sale as a going concern.

Particulars and conditions of sale may be obtained gratis of the Liquidator, Mr. W. B. Peat, Royal Exchange, Middlesbro'; at the office of R. Mackay and Co., 3, Lothbury, London; at the Works; of the Auctioneer, at his Offices, Middlesbro'; of Messrs. Van, Sandan, and Cumming, 13, King Street, Cheapside, London; and of Messrs. Jno. T. Belk and Parrington, Solicitors to the Liquidator, Post Office Chambers, Middlesbrough.

Dated this 2nd day of March, 1880.

JOHN W. M. HAWKINS,
Chief Clerk.

Van Sandan and Cumming,
13, King Street, Cheapside, London.
Agents for John T. Belk and Parrington,
Middlesborough, Yorkshire,
Solicitors for the Liquidator.

BY ORDER OF THE SECRETARY OF STATE FOR INDIA IN COUNCIL.

The Director-General of STORES for INDIA is prepared to receive TENDERS from such persons as may be willing to supply BAR, ANGLE and HOOP IRON.

The conditions of Contract may be had on application to the Director-General of Stores, India Office, Westminster, S.W., and Tenders are to be left at his Office at any time before Two o'clock p.m. on the 16th day of March, 1880, after which no Tender will be received.

A. ABERCROMBIE JOPP,
Director-General of Stores.
India Office, 9th March, 1880.

BELFAST AND COUNTY DOWN RAILWAY.
OLD RAILS.

The Directors of this Company are prepared to receive TENDERS for about 100 tons of OLD BRIDGE and FLANGE RAILS at per ton of 2240 lbs. Delivery to be taken on the Company's premises, Belfast.

Terms cash.

The Directors do not bind themselves to accept the highest or any Tender.

Tenders to be lodged with the Secretary on or before the 23rd inst.

By order,
JOHN MILLIKEN,
Secretary.
Belfast, 5th March, 1880.

Locomotive Tank Engines of all sizes and for all gauges. Several in stock and in progress.—Fletcher, Jennings and Co., Lowca Engine Works, Whitehaven.

BUILDING EXHIBITION

TO BE HELD AT THE

AGRICULTURAL HALL, ISLINGTON,

On the 12th, 13th, 14th, 15th, 16th, and 17th APRIL, 1880.

The object of the Building EXHIBITION is to draw public attention to the recent important improvements in Building and Furnishing Appliances. All interested in the house and home should visit and examine for themselves the models and drawings therein shown. Manufacturers also should take an early opportunity of securing room in which to exhibit their productions, as, although the building is of immense size, space is fast being filled up.

Section I.—ARCHITECTURAL.—Drawings, Plans, and Models.

Section II. — CONSTRUCTION. — Bricks, Stone, Concrete, Wood, &c., and Sanitary Appliances in Pottery or Concrete. Constructive Ironwork.

Section III.—ENGINEERING. — Machinery and Engineering Appliances.—Taps, Valves, Hot-water and Steam-Heating Stoves, &c., &c., and Metal Sanitary Appliances.

Section IV.—DECORATION.—Wall Papers, Paints in Oil and Tempera, Window-glass Staining, Plaster, and Papier Mache, Ornaments, Encaustic Tiles, &c., Marble and Terra Cotta, &c., and Carved Woodwork.

Section V.—FURNITURE and PORTABLE DECORATIVE ARTICLES, including Busts, Pottery, Metal Work, Turned Ornaments in Wood, Stone, or Metal, &c., &c.

Exhibits will be received at the Hall on and after April 5th, but not later than April 8th. All exhibits and benches, &c., must be removed by April 21st.

Regulations for Exhibitors, and all particulars can be obtained of

MR. JOHN BLACK,
Manager.
161, Strand, W.C.

IN LIQUIDATION.

To be Sold by Private TREATY, as a going concern, on the Great Northern Line of Railway, a well-established ENGINEERING BUSINESS, comprising the following branches, viz:—

The Manufacture of Stationary Engines and Boilers.

Portable and Combined do.

Agricultural Implements of all classes,

And especially the Manufacture of Wrought Iron Cranks, for which a complete Plant of Patent Machinery has been put down; also General Iron Founding with all the Appliances for carrying on and extending a first-class trade.

The Machinery and Tools are by well-known makers, and the new Buildings are erected upon land secured on a 999 years' lease.

Full particulars can be obtained from Mr. Isaac Jenks, of Wolverhampton; Mr. Thomas Leman, Accountant, Nottingham; or Messrs. Corser, Fowler and Langley, Solicitors, Wolverhampton.

To be Sold, the Well-Constructed IRONWORKS, situate on the banks of the Western Canal of the Weaver Navigation, in the township of Clifton, in the county of Chester, together with the Chimney Shaft, 20 Puddling and Re-heating Furnaces, Seven Plate, Sheet, and Bar Rolling Mills, Fitting and Pattern Shops. Smiths' Shop, Moulding Shop, Laboratory and Offices, Grinding Shed, Drying House, &c. Also the Plant, &c., thereon, comprising vertical steam engines with shafting, gearing, and pulleys complete; drilling machine, grinding machine, disintegrators with hoppers, shafts, pulleys, elevators, &c.; cranes, rolling mills, steam hammers, shears, punching machines, circular saw, steam winch, steam travelling crane, weighing machines, Pooley's patent; mortar mill, with all the requisite appliances for carrying on the manufacture of iron. The works are conveniently situate for the manufacture of iron from purple ore, there being an abundance of that article in the district. The St. Helens and other coal fields are near, and connected by canal and railway. Distance from Runcorn two miles, from Liverpool 18 miles. The site of the works comprises 5a. 2r. 22p. and (with the exception of a small slip of freehold to the west of the works) is held under a lease for a term of 999 years, from the 25th March, 1876, subject to an annual ground rent.—A plan of the site of the works and printed particulars of the plant may be had and further information and orders to inspect obtained on application to Messrs. Harmood Banner and Son, 24, North John Street, Liverpool; or to Messrs. Bateson and Co., solicitors, Liverpool.

TO IRONMASTERS AND OTHER FURNACE PROPRIETORS.

THE NEW PATENT FLINT FURNACE BRICKS.

Salwey and Co. having obtained Letters Patent for the protection of this VALUABLE INVENTION, which produces bricks of a far superior quality to all Dinas and other fire bricks, are now anxious to test them on a commercial scale. They are now prepared to supply a sufficient number of bricks gratis to firms selected from those who may apply, to erect a furnace on a sufficient scale to test the value of the Patent, provided that a reliable report will be guaranteed. By this invention a brick is produced from flints (which consist of pure Silica) with as much textile cohesion as a fire-clay brick, and with greater refractory power than any Dinas or other Silica Brick.—See "Iron," page 655, 23rd Nov., 1878.—Apply to E. R. Salwey, Bryngarw, Bridgend, South Wales.

WINDSOR IRONWORKS, NEAR EDGE HILL STATION, LIVERPOOL.

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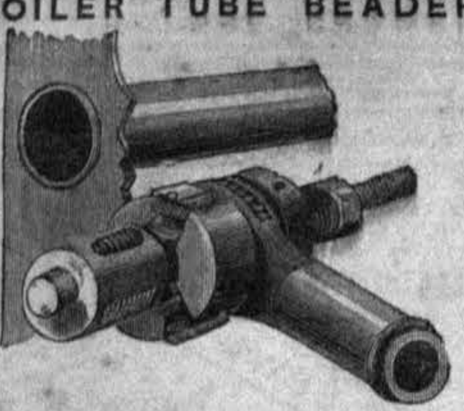

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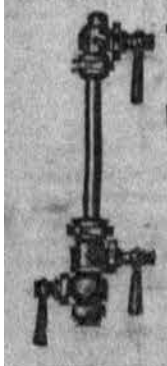

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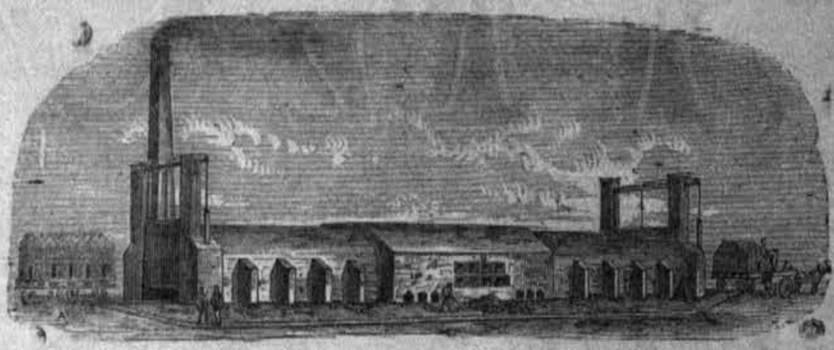

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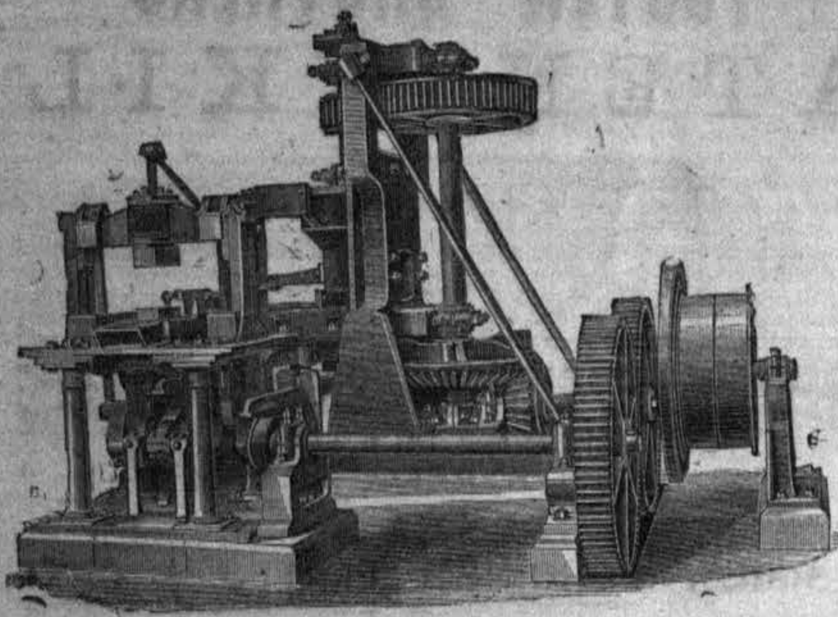

The above Machine, recently introduced, is the result of 30 years' experience in manufacturing Machinery of this class. By its action the clay is first pugged, then moulded under considerable pressure, and on delivery from the mould table the bricks are again powerfully pressed before removal, when they are ready for placing direct in the kiln, thus embracing all the advantages of the semi-dry making, and at the same time the quality produced is that of the best plastic made and pressed brick.

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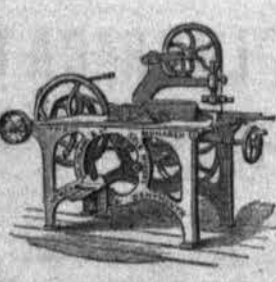

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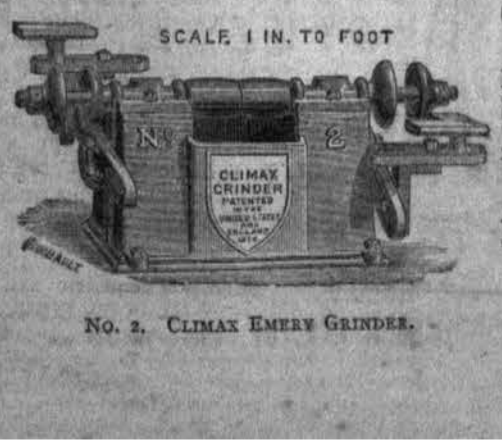

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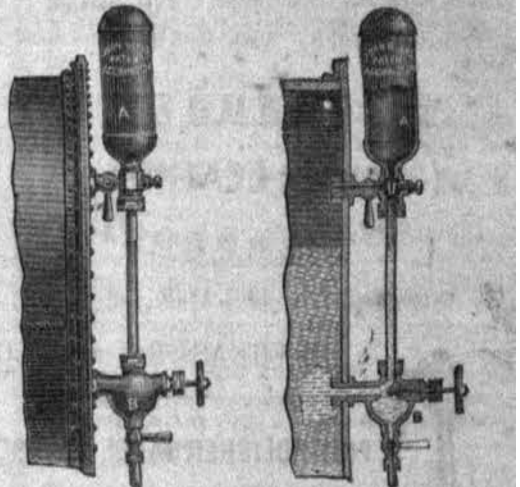

A is a cylindrical copper vessel supplied with steam through the top gauge cock, and being exposed to the atmosphere it is constantly condensing the steam, thus causing a downward flow of clean water into the glass tube and bottom gauge cock, and so excluding dirt or sediment which would otherwise enter from dirty water in the boiler. When the blow-off tap is opened the clean water is ejected, and on closing it any dirt or sediment that may have entered whilst blowing through settles in the dirt box, B, which dirt is immediately discharged the next time the blow-off top is opened.

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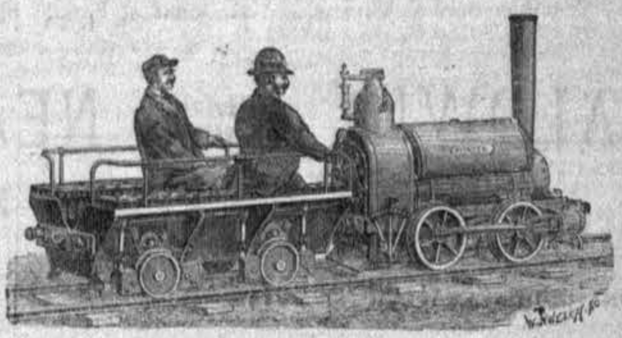

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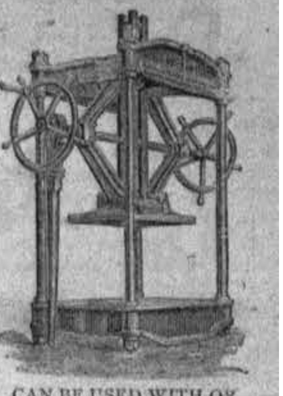

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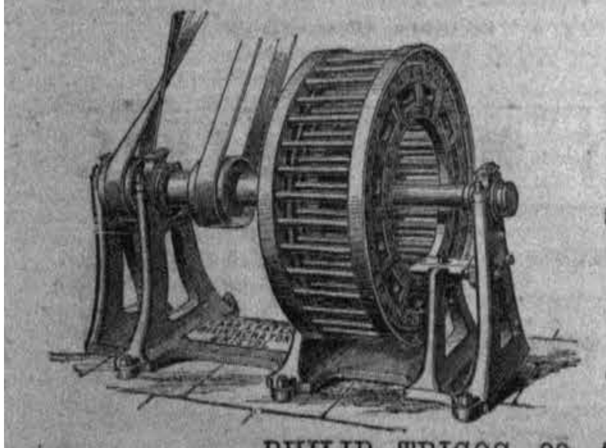

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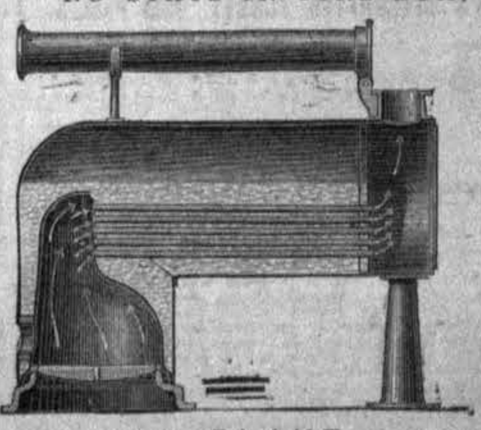

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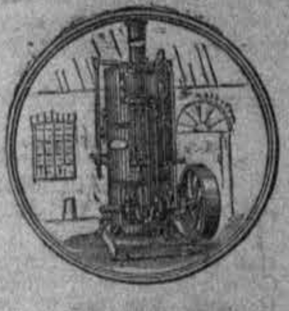

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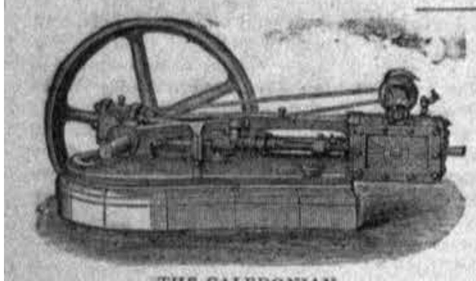

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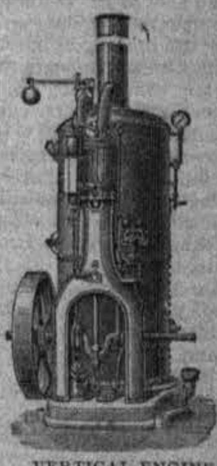

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6 × 3½	2½ × 2½	4 × 1½ = 7 „	6 × 2 = 11 „	8 × 4 = 22 „	10 × 4¾ = 32 „	14 × 6 = 60 „	5 × 3	9¼ × 3½
5 × 3½	2 × 2	4 × 3 = 12 „	6 × 3 = 16 „	8 × 5 = 29 „	10 × 5 = 36 „	16 × 6 = 62 „	3 × 3	8 × 3½
4 × 3	1½ × 1½	5 × 2 = 8 „	6 × 5 = 29 „	8 × 6 = 34 „	10 × 6 = 54 „	18 × 6½ = 82 „	2½ × 2½	6 × 2½
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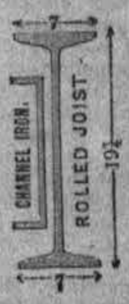

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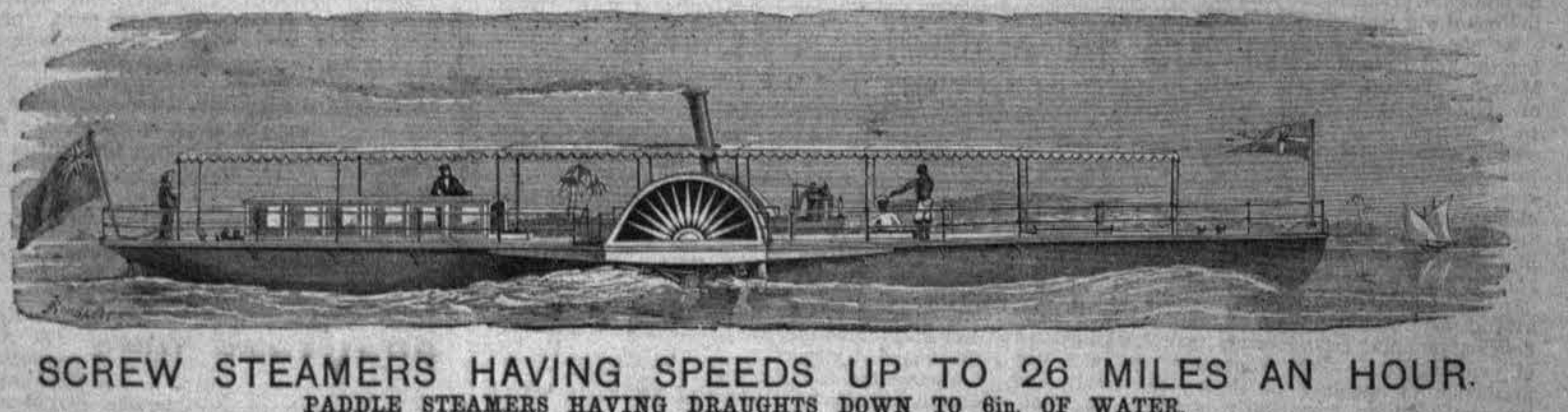

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C., W, & Co. beg to intimate they are prepared to treat for purchase of Patents or the working of the same on Royalty.
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IRON.

LONDON, FRIDAY, MARCH 19, 1880.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE twenty-first session of the Institution of Naval Architects is now being held in the Hall of the Society of Arts—by permission of the Council of that body—under the Presidency of Lord Hampton, who has for twenty-one years held the position of President. The session commenced on Wednesday, was carried over yesterday, and will be concluded to-day, a large number of papers having been sent in for reading and discussion. Upon the members assembling on Wednesday the first business was the reading of the Annual Report of the Council, from which it appears that the finances of the Institution continue to be in a satisfactory condition. The Council express deep regret at having to announce that Lord Hampton had stated his intention of resigning immediately after the annual meeting. The Earl of Ravensworth has been selected by the Council as the new President. At the same time the Council has much pleasure in stating that Lord Hampton will continue his invaluable services to the Institution as one of its Vice-Presidents. The Library Fund started in 1878 continues to increase, and the Library has been added to by the purchase of many new books. The Council deplores the loss by death of one of its number—viz., Mr. J. R. Napier, F.R.S., and two members of the Institution, viz., Mr. Luther Watts and Mr. P. Morrison Swan, and of one associate, viz., Mr. Thomas Black. The report having been adopted, and some other routine business having been disposed of, the President, Lord Hampton, retired, and the Earl of Ravensworth was unanimously chosen to take his place. In accepting the appointment, Lord Ravensworth expressed his high sense of the honour which had been done to him, and referred to the valuable services of the Institution in bringing to bear on a great national industry all the talent the nation can command and in assisting the Admiralty with their combined experience.

Lord Hampton then resumed the chair, and addressed the meeting, observing that they would have the most implicit confidence in the abilities and competence of his successor. He alluded to the explosion of the 38-ton gun on board the *Thunderer*, remarking that it had formed a subject of discussion at their last meeting, and it was satisfactory now to find that their conclusions at that time that breech-loading guns were best suited for naval purposes were about to be acted on by the Admiralty. The inference to be drawn from the *Thunderer's* explosion was that breech-loading was the right principle for the Navy. He afterwards drew attention to the use of steel for facing armour plates and for other purposes in shipbuilding, observing that with regard to ships of war, steel afforded a greater power of defence with a reduction of one-third in the weight. The President concluded by commending the proposition to employ mercantile vessels in time of war for the defence of the country.

At the conclusion of the President's address a lengthy and an important paper was read by Mr. B. Martell, Chief Surveyor of Lloyd's Registry, on "Causes of Unseaworthiness in Merchant Steamers:" In the recent loss at sea of many steamers, involving great sacrifice of life and immense destruction of property, there were, the author observed, some facts which stood out only too clearly as elements of danger. These were (1) weakness of structure from faulty construction and inferior material; (2) Deterioration; (3) Absence of proper control over cocks, valves and pipes, connecting engines and boilers with the sea, and want of proper arrangement of bilge pump suction; (4) Faulty and deficient pumping arrangements; (5) Breaking down of machinery; (6) Bad navigation; (7) Inefficient protection of openings on deck; (8) Hasty and improper loading, particularly of grain cargoes in bulk; (9) Deficiency of stability, from disproportionate dimensions, combined with undue height of double bottom; and (10) Overloading. Want of structural strength, the author emphatically maintained, had had nothing to do with the losses under consideration; but the danger that sometimes arose from local deterioration had, he considered, been abundantly shown by experience, mentioning an instance in which, owing to inferior cement having been used, the plating of the ship's bottom, eight-sixteenths thick, had been eaten through, from the effects of a sugar cargo, within six months from the date of launching. With regard to sea-cocks the danger from that source had of late considerably diminished, but it had in the past caused the loss of many steamers. As to pumping arrangements, they had been improved in later-built steamers. Accidents from the breaking down of machinery had happened too often; but it was now more carefully inspected. Bad navigation, leading to collisions and running ships on shore, prevailed, and that largely, although the officers of the mercantile marine had considerably improved of late years. He felt certain many losses had occurred from inefficient protection to boiler and other openings on deck; yet the special requirements of cargo ships were neither realised nor applied to the extent they should be. The question of hasty and improper loading the author discussed at great length, and offered the following suggestions as to the chief causes contributing to the instability and consequent unsafety of vessels engaged in the grain-carrying and similar trades. These were—small relative breadth to both depth and length, great fulness of form throughout below the water line and extreme flatness of floor, low freeboard and undue height, and extent of double bottom. The remedies he recommended were greater beam, a more shapely form, a greater freeboard, and a double bottom not deeper than necessary for the purposes of water ballast. Mr. Martell then went at considerable length into the question of grain-loading. He held that a cargo composed partly of bulk and partly of bag-grain could be made as safe as a cargo containing all bags, and thought he had shown that behind the losses which had occurred there lay dangers from deficient stability and other causes which could not be cured by carrying all grain in bags. In conclusion, he said, with regard to overloading, that it was a serious source of peril, but that the subject was one surrounded by enormous difficulties. He hoped, however, that by attention being drawn to it, and the magnitude of its resulting evils being shown, this source of danger, which was getting less, would soon altogether disappear.

In the lengthy and animated discussion which followed the reading of Mr. Martell's paper, the first speaker was Mr. C. W. Merrifield, who pointed out that although the paper was a long and an elaborate contribution it was by no means exhaustive, inasmuch as it was impossible at the present time to exhaust the subject. He considered that the question of stability ought to be taken into consideration much more seriously than it hitherto had been. Sufficient care was not bestowed, nor sufficient money spent upon the calculations for ships, upon which point everything depended. He then referred to the tonnage laws, which he observed were in a wretched condition, and the Government should be urged to revise and amend them. Mr. MacFarlane Gray followed with some observations bearing out what Mr. Martell had stated with regard to the inefficient protection to engine and boiler openings, after which Mr. Scott Russell observed that double bottoms in ships were great sources of danger. They were not only liable to rapid decay, but had been the cause of ships capsizing. The remedy he proposed was subdivision into a greater number of compartments than had hitherto been adopted in practice. He suggested a central longitudinal bulkhead throughout the vessel. The only objection he could see to it was that it might once in a way interfere with the shipment of a large piece of machinery. That, however, should not be allowed to stand in the way of what he conceived to be a valuable improvement. Mr. Scott Russell then advocated continuous spar decks, as recommended by Mr. Martell, and suggested that vessels should be built with wider beam and finer ends.

Admiral Sir Spencer Robinson, was the next speaker, and he considered that water-ballast greatly improved the stability of ships. He thought it very desirable that the captains of vessels should be provided with the curves of stability of their respective ships, and all other detail technical information. In fact, such information should be diffused generally amongst those connected with the ship. He observed that the ship's qualities, as laid down by her constructor, should be indelibly registered on the vessel for inspection and ready reference by all. He agreed with the strictures passed on the tonnage laws by previous speakers. Mr. Bennett then advocated the use of water-tanks in ships in place of double bottoms for water-ballast, and pointed out in detail the advantages derivable from the tank system. Mr. Ravenhill dwelt upon one of the causes of unseaworthiness assigned by Mr. Martell—namely, the breaking-down of machinery; and observed that he was glad to find that Lloyd's laid such stress upon the qualified inspection of machinery. He found fault with the careless stowage of cargo which so greatly prevailed, and which undoubtedly greatly led to losses, owing to the cargo shifting. He agreed that the captain should possess the requisite knowledge to enable him to load his vessel with proper regard to stability. He laid great stress upon the fact stated in the paper, that, since the increase in the penalty for neglect of the Port Warden's regulation at Montreal for loading, not a single grain-laden vessel from that port had foundered at sea; whereas, previously, losses were constantly occurring.

After some remarks from Mr. W. John, Mr. W. Denny and other speakers, the President observed that he had never listened to a more interesting, practical, and important paper than that read by Mr. Martell. The discussion, too, had been conducted by some of the most eminent members of the Institution and was well worthy of the paper. The inference to be drawn from the paper and the discussion was that the misfortunes dealt with were for the most part preventible. They arose from two causes mainly, namely, imperfect construction and improper loading. Those two causes were remediable, and every means should be taken to effect their remedy, and to bring about a better condition of matters by judicious local regulations, such as obtained at Montreal, and by other methods of dealing with the question. The tonnage laws certainly tended to prejudice the safety of vessels, inasmuch as they led to unsafe forms of construction being adopted in order to avoid the undue operation of those laws which demanded revision at the hands of the Legislature. The President concluded by moving a vote of thanks to Mr. Martell for his paper, which was cordially given. Mr. Martell having acknowledged the vote of thanks, proceeded to answer some points which had been raised during the discussion, after which the meeting adjourned.

Upon the members re-assembling yesterday, Mr. N. Barnaby read a paper on ships of the "*Nelson*" class, in which he gave particulars of the two ships *Nelson* and *Northampton* as they have been completed, including the trials of speed, placing beside them corresponding particulars of two ships of an earlier type, designed for similar work, namely, the *Iron Duke* and the *Bellerophon*. The discussion on this paper was but brief, and was followed by the reading of a long paper by Mr. J. Scott Russell on the true nature of the resistance of armour to shot. The discussion on this paper was also very brief, and at its close a paper was read by Mr. A. C. Kirk, descriptive of a method of analysing the forms of ships and determining the mean angle of entrance. The reading of a paper by Mr. J. A. Normand, on "The steam trial of H.M.S. *Iris*, and the resistance of screw propellers," brought the morning sitting to a close. Upon re-assembling in the evening several other papers were read. Of the proceedings, both in the morning and evening, as well as of those of the concluding meeting this day (Friday), we reserve details for next week, simply observing that the session, so far as the first two days have gone, has proved in every way a success.

OUR TRADE SUMMARY.

THE quietness which for a week or two back has fallen on the iron trade continues; and the political excitement that accompanies a general election has also not been without effect in the same direction. Prices of Glasgow warrants have steadily declined, with, however, a considerable amount of business doing, owing to holders who had bought at the former high prices forcing their iron on the market. Shipping orders have greatly decreased, there being scarcely any from the United States. The closing prices on Wednesday ranged from 56s. 9d. to 57s. 4d. Shipments of Scotch pig during the week were, however, about double those of the corresponding period of 1879. The malleable works are well employed, but getting towards the end of their orders, and new inquiries are few in number. This is also the position of affairs in the shipbuilding yards, and the customers of both engineers and founders seem likewise to hold back their orders. Dulness was equally manifest at Middlesborough on Tuesday, but the disposable iron in the district is now chiefly in second hands, and the makers are well sold forward, and not in a position to undertake new contracts. The finished trade is also somewhat dull, but in a healthy condition nevertheless. Engineering and its auxiliary branches are doing pretty well. The slight relapse in pig-iron affects all the northern districts more or less, but it is not considered at all dangerous. Indeed, the present comparatively quiet condition of trade is to be preferred to the feverous state which is produced by or produces excessive speculation. There is, at the same time, little, if any, diminution of output, and new works are being brought into operation. For all manufactured qualities there is an active and increasing demand, and the shipyards on the Tyne are busily engaged in completing old orders that they may begin upon new contracts. The hematite iron trade of the north-west is slacker, and prices lower; but an improvement in both respects is confidently anticipated as the season advances. The American demand is now of inconsiderable proportions, but there has been an increase in European orders, and several parcels of considerable magnitude have been bought for the colonies. Although the output has of late been considerably enlarged, preparations continue to be made for putting, with all despatch, new furnaces in blast, and relighting old ones. Prices, so far as present sales are concerned, have been reduced for Bessemer qualities to £5 5s. and to £5 for forge, although makers decline to sell forward under £6 per ton. The Barrow shipbuilders and marine engineers are busy enough, and most of the other industries hold orders that will strain all their energies for some months. From Manchester we learn that although there is almost an entire suspension of the American demand the market is keenly watched by American agents, so that it is believed they have still considerable orders in reserve. In other respects, the falling market checks business. The partial improvement formerly noticed in the local trades continues. Throughout Yorkshire there is little alteration, ironworks of all descriptions being kept fairly well going in the main, which is also the case in the minor centres of Derby and Staffordshire. A heavy weight of orders for Sheffield cutlery has been received from Australia, and an improvement before long, both as regards demand and quotations, is confidently anticipated. In the local hardware industries of Birmingham there is a continuance and slight extension of activity. As respects the export trade, some good orders have come in from South America, as well as other quarters; but dulness continues to characterise the home demand. The kindred industries of South Staffordshire are doing fairly well. With regard to coal, there is no change to report. The sale is generally inactive and prices low.

FLEUSS' DIVING HELMET.

A STEP in advance in diving equipments has recently been made by Mr. Fleuss, who has ingeniously contrived to dispense with the use of pumps and air-pipes, although the wearer of the helmet he has devised may remain under water several hours. The means by which he is enabled to effect this stay are all contained within the dress, and there is nothing whatever communicating with the surface except a signal cord. The principle consists in purifying the air exhaled by the diver, and revivifying it with oxygen, the same air being breathed over and over again, *minus* carbonic acid, and *plus* fresh oxygen at each inspiration. To this end a close-fitting leather shield, provided with inlet and outlet valves, is held in position over the mouth and nostrils of the diver by elastic fastenings. The exhaled breath passes out through a flexible tube communicating with a purifier which is carried in front of the diver and under the dress. This purifier is a flat metallic chamber, having a perforated inner false bottom, and being divided vertically from the top to the false bottom into two compartments. Each of these compartments is fitted with indiarubber sponge, saturated with a solution of caustic alkali. The exhalations enter at the top of one compartment, pass down it through the false bottom and up the second compartment. From thence they pass by a tube to a second purifier, carried at the back of the diver. This purifier is similarly constructed and charged to the front one, but is of somewhat larger dimensions. The exhalations enter at the top and pass down the first and up the second compartment, by which time the air has been deprived of all its deleterious absorptions. It then enters the interior of the helmet and surrounds the diver's head, where it is revivified by the addition of oxygen. This gas is contained in the helmet itself, which is made double for the purpose, and consists of an inner and outer casing, so that it is somewhat larger externally than the ordinary diver's helmet. The oxygen is stored in the helmet under a pressure of about 200 lb. per square inch, and its admission into the air-space is regulated by the diver, by means of a small valve actuated from outside the helmet. The storeage space in the helmet is of sufficient capacity to contain four cubic feet of oxygen, which supply will last for four hours, the longest time a diver would be required to remain under water in ordinary practice. In like manner, the purifiers contain a sufficient quantity of the caustic alkali to serve for a similar period. We were present a few days since at a demonstration with this invention at Messrs. Siebe, Gorman and Co.'s Neptune Works, Mason Street, Westminster Bridge Road, those gentlemen being the sole manufacturers and agents for the helmet and gear. Mr. Fleuss descended into fourteen feet of water, and remained there for about half an hour without any communication with the outer atmosphere, and coming up as fresh as he went down. He has remained under water for one hour and ten minutes, only then being obliged to come to the surface on account of the cold. He informs us that he has worn the dress for 2¼ hours in a room with perfectly satisfactory results. The invention is exceedingly ingenious as well as practical, and will no doubt prove very useful in the numerous cases which are of daily occurrence, especially in connection with docks and other similar works, where the assistance of a diver is required occasionally, but quickly, and under circumstances in which to be unhampered by air-pumps, and their necessary gear and attendants, would be a great gain.

ELECTRIC LIGHTING.

SOME important and interesting experiments have been carried out in connection with the Jablochkoff system of electric lighting by Mr. J. A. Berly, the engineer to the Société Générale d'Electricité. They were conducted at the Victoria Station of the Metropolitan District Railway, where the Jablochkoff system of electric lighting was introduced towards the close of last year.* About that time Mr. Berly had the two rails of the up-line connected together by a copper wire (insulated), both at Charing Cross and at Victoria Stations. He also had the two rails of the down-line connected up in the same manner. He tried experimentally: (1) to maintain five lights on the up-circuit, using the up-line as return wire; (2) to maintain five lights on the down-circuit, using the down-line as a return wire, and succeeded. Subsequently he carried out the lighting of the station with one main wire only in each circuit, and the rail as the return wire in each circuit. In the third place, Mr. Berly tried to maintain five lights on the up-platform circuit, using the up-line as return at Charing Cross, and the down-line as return at Victoria; and in the fourth place to maintain five lights on the down-platform circuit, using in a similar way the down and up lines as return. Both succeeded separately. He then lighted the station with both circuits connected as explained in the third and fourth experiments, which was done successfully. Later on, namely, on the 2nd and 4th inst., he joined, experimentally, the two wires of Victoria Station into one, making, therefore, a total circuit of about seven miles of wire. He maintained, in the middle of that distance, that is 3½ miles from the Gramme machine, five lights burning, and by the side of which he kept burning another five lights mounted on a circuit of about 250 yards of wire. He reports that both circuits appeared to burn with the same brilliancy, and the candles on the short circuit burned very little quicker than those on the long one.

With regard to the progress of the Jablochkoff light on the Continent, we understand that the Paris Municipal Council has renewed for one year (expiring 1st March, 1881) the contract for lighting the Avenue de l'Opera, the Place de l'Opera, and the Place du Theâtre Français, with the Société Générale d'Electricité. The Sous Secrétaire d'Etat at the Ministere des Beaux Arts has just given the necessary authorisations to the Société for re-lighting the Salon at the Palais de l'Industrie in June next. The Hippodrome, which has been lighted for the last two years with sixty Jablochkoff lights and twenty Serrin regulators, will be lighted now by means of 128 Jablochkoff lights, the twenty Serrin regulators being replaced by sixty-eight Jablochkoff lights. The application of the system has extended to a number of industrial establishments in France and elsewhere since the commencement of the present year, and including the celebrated Creusot Works.

THE TRANSMISSION OF HEAT.

IN instituting trials to determine the speed of transmission of heat in an iron rod, Monsieur C. Decharme noted the differences of temperature from minute to minute of four thermometers placed at intervals of 20 centimetres from each other, and from both ends of a rod of homogeneous iron, 1 metre long and 21 millimetres thick, resting on two cork discs, with one end subjected to the heat of a gas flame. The thermometers, which registered an alteration of temperatures of 0·1 Centigrade accurately, were placed in holes 14 millimetres deep and 6 millimetres wide, packed with quicksilver or powdered iron and sheltered by a screen from the influence of radiated heat.

The heat when applied to the end of the rod reached:

	minute.
Thermometer No. I. 20 centimetres from the flame, in	1·00
,, ,, II. 40 ,, ,, ,,	4·50
,, ,, III. 60 ,, ,, ,,	10·00
,, ,, IV. 80 ,, ,, ,,	16·00

Before the application of the heat all four thermometers indicated 7·30 Centigrade, that being also the temperature of the room taken at a level of 20 centimetres below the bar, 3 metres away from it. The above times, which differ only slightly from 1, 4, 9 and 16 minutes, show that the progressive speed is approximately the inverse ratio to the squares of the distances of the thermometers from the source of heat. The times at which the four thermometers became stationary were respectively 150, 190, 220, and 250 minutes, nevertheless the heating was continued for 300 minutes, when they registered 98·8°, 42·7°, 23·0°, and 15·5°, or in excess of the surrounding air, which had meanwhile risen to 9·5°, respectively 89·3°, 33·2°, 13·5°, and 5·7°. As soon as the flame was extinguished the thermometer began to recede, and in 200 minutes had fallen to the temperature of the room. Monsieur Decharme constructed first a system of curves to show the more regular and gradual process of cooling, and then, with the help of numerical data, a system of synchronic curves of all four thermometers showing the thermal waves from 10 to 10 minutes as they transmitted themselves through the rod; from which the temperature of any point of it, after a certain space of time, either during the periods of heating, or of cooling, or even while in a stationary condition, can be ascertained. In the above trials a sufficient time was allowed to elapse each time after extinguishing the flame until each thermometer became stationary, and it was found that the heat continued at first steadily to spread itself through the rod as if it had attained a certain velocity which it only gradually lost, each thermometer attaining its maximum so much later in proportion as it was farther from the sourse of heat, whereas the temperature of the thermometer nearest to it began first to recede, and was followed at intervals by that of the others in the successive order of their distances from the first. In other trials the rod was heated under similar conditions for 5, 10, 15, and 20 minutes, or during periods of T, 2T, 3T, 4T, and the following relation was found between these periods, and the spaces of time t, t', t'', t''', which elapsed between the moment of removing the source of heat and that of the thermometers attaining their maximum temperature: $T + t = 2T + t' = 3T + t'' = C$. That is, the sum of both the corresponding values of time is a constant quantity.

THE "NOVELTY" SIDE-DELIVERY REAPER.

AT the recent Paris Cattle Show, Messrs. Picksley, Sims and Co., of Leigh, Lancashire, exhibited two automatic side-delivery reapers for one horse. One of these machines was worked all last autumn, at farms in the neighbourhood of Manchester, on ground purposely selected for its roughness and inequality, so as to thoroughly test its powers and endurance; and we are glad to learn that the result was perfectly satisfactory. This implement is very light for the horse, having no side draught, is very compact, and will pass through an ordinary gateway; it works noiselessly, has comparatively few parts, and may be easily taken to pieces and put together again. The Johnstone cam is used for controlling the rakes, so as to make them, or any of them, deliver or merely swathe at pleasure; but the method by which the cam is actuated is new. If it be required to alter the size of sheaf in going along the cut corn, and if there be only a quarter of a sheaf left, this is returned to the platform by the driver putting his foot on a catch connected with a cord, which, by lifting a friction bolt, causes the rakes to rise without delivering, and in this way no loose corn is left up and down the field.

Fig. 1 of our illustrations shows a perspective view of the two-horse machine in working order; fig. 2 is a vertical section of the principal portion; fig. 3, a horizontal section on line AB of fig. 2; and fig. 4, an inside view of the land wheel, showing the arrangement whereby the height of platform is regulated with reference to the land wheel. The remaining figures show details of the gear for controlling the rakes, and will be referred to more particularly below. The land wheel, on which the whole weight is balanced, is 3 feet in diameter, with an unusually wide rim of T iron shrunk on to the remaining cast portion, which is dished out to allow room for the height-regulating apparatus, and includes an internal spur wheel on its near side. The wheel runs loose on the axle, A, which latter has keyed on to it the quadrant, B, forming a chamber for the quadrant plate, C, keyed on to the shaft, D. The quadrant, C, has teeth formed on its circumference, so that, by means of the spur pinion, E, and the ratched wheel, F (see fig. 4), actuated by a ratchet lever, the position of the inner quadrant may be varied with respect to the outer, and thus the height of the machine from the ground be adjusted with the greatest nicety. Motion is communicated from the land-wheel by means of the internal spur-wheel formed upon it, through the carrier-wheel, G (fig. 4) on the axis of the outer quadrant, to the spur-pinion, H (fig. 2), running loose on the the shaft, D, but thrown in and out of gear by a friction-clutch. Throwing this into gear has the effect of causing the shaft, D, to revolve with the land-wheel, though at a much greater speed, owing to the multiplication due to the gear; and this shaft has keyed on to it the combined bevel-wheel and pinion, L. The wheel takes into the spur-pinion on the short vertical shaft, M, carrying the crank disc for giving the reciprocating motion to the knife; and the pinion gears with the bevel-wheel keyed on to the vertical shaft, N, which, through its spur pinion and the internal spur-wheel fast on the shaft, O, turns the head carrying the rake arms. This, it will be noticed, is a very compact arrangement for controlling the rakes, superseding the multiplicity of wheels generally used for this purpose. The gear is well boxed in by the casing shown in the plan (fig. 3), and the lower part of which carries one end of the platform, the other being supported by a small conical furrow-wheel. A portion of the top of the cover is easily removable for oiling and inspection; and it may be mentioned here that the shaft, D, is made hollow, so as to afford an oil-reservoir, and that the covers of all oil-cups are provided with springs for keeping them from being jolted off. The cover also affords, by means of the vertical bars, P, P, P, a solid support for the fixed cam, Q, for actuating the rakes, to which operation the four remaining figures more particularly relate.

Fig. 5 is a plan of the fixed cam, Q, in fig. 2, with its outer path for causing the rake arms to rise without raking, and its inner groove, entrance to which is afforded by the switch, R, for allowing them to rake, exit being obtained by pushing aside the switch, S. Both these switches are shown closed, being kept in

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* *Vide* Iron, vol. xiv., page 772.

THE "NOVELTY" SIDE-DELIVERY REAPER.

BY MESSRS. PICKSLEY, SIMS AND CO., LEIGH, LANCASHIRE.

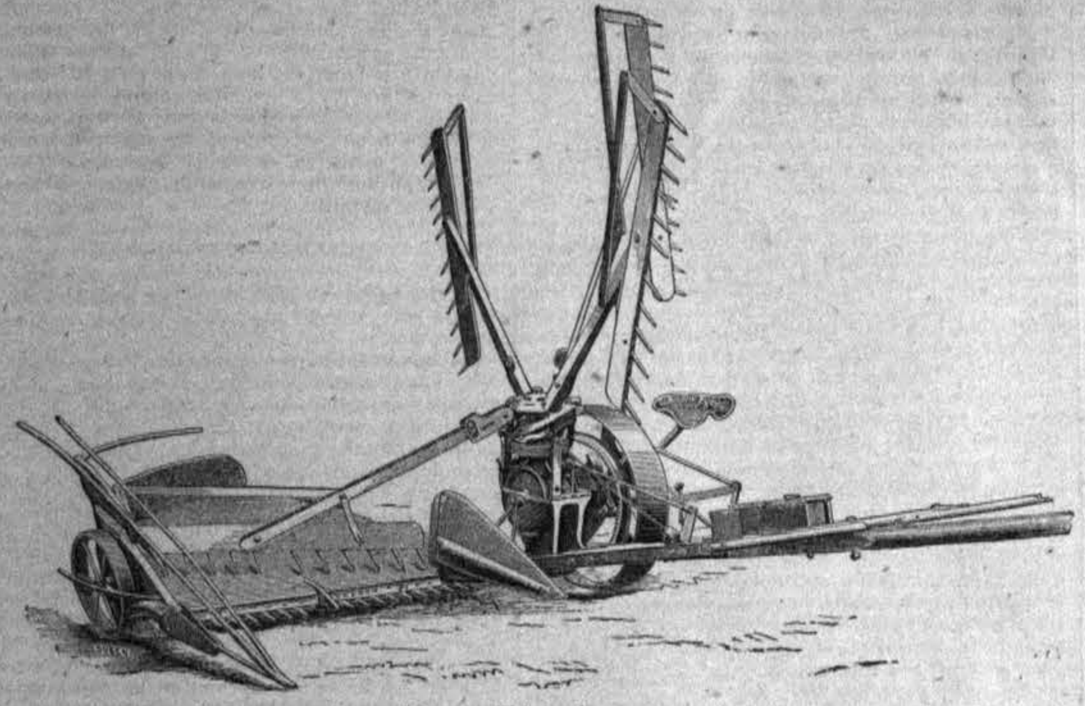

Fig. 1.

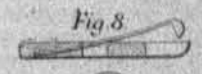

Fig. 8.

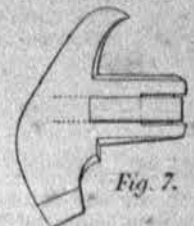

Fig. 7.

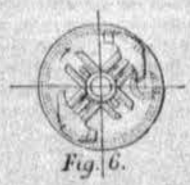

Fig. 6.

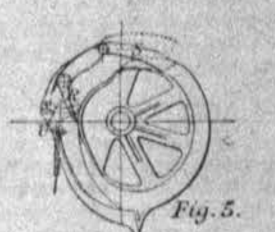

Fig. 5.

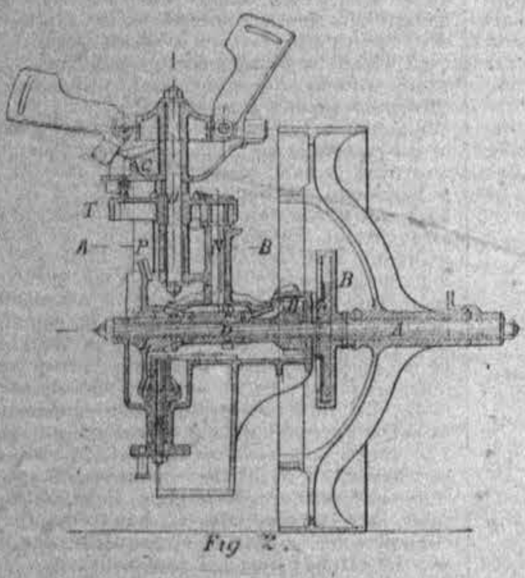

Fig. 2.

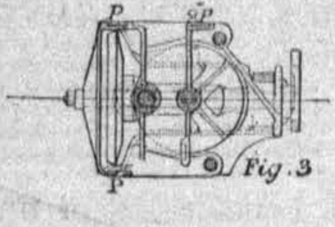

Fig. 3

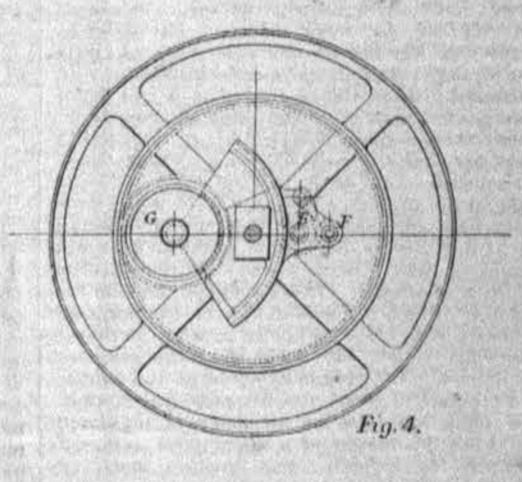

Fig. 4.

that position by a plate spring, as shown, until made to assume the position indicated by the dotted lines. Fig. 6 is a plan of the internal spur-wheel, which, keyed to the shaft, O (fig. 2), revolves with it, immediately below the fixed cam. The upper surface of this wheel forms a disc with four radial grooves for receiving cams, one of which is shown separately, with its locking spring, in plan at fig. 7, and in section at fig. 8. These cams, in their rotation, push aside the stud, T, which opens the switch, R, so as to allow the rake rollers to pass into the inner path of the fixed cam for causing the rakes to sweep the platform. Any number of the four cams may be inserted in their radial grooves according to the nature of the crop; in fig. 6 two only are shown, in which case every other rake will deliver the cut corn, while the remainder pass without delivering. But if the driver, when the four cams, or any of them, are set for raking, should deem it expedient to allow any one of them to pass without raking, he pulls a cord by depressing a pedal within easy reach from his seat, by means of the lever working on the pivot U (fig. 5), thus raising the stud T, by means of its flange, seen in fig. 2, so as to be clear of the cam in its revolution, and therefore not affected by it. A spiral spring, introduced between the flange of the stud and the under side of the fixed cam, causes the stud to again descend, on the cord being relaxed; and the end of the lever has a radial slot (see fig. 5) for allowing the stud to pass freely when acted upon automatically by the revolving cams.

Slotted holes will be observed in the sockets of the rake arms (fig. 2), for taking the bolts that hold the arms, and by which means the rakes may be set level with the platform. A lever, working on a toothed sector, is provided on the driver's right hand, for tipping the platform, so that the knife may cut equally well on going up or down hill as on level ground; by means of this arrangement the fingers may also be raised clear of any ordinary obstacle. All the shafts are of steel; and the sectors for regulating the height of the machine and the gear casing are of malleable cast iron, very little ordinary cast iron being employed. The nuts are secured by split pins sunk in them, an arrangement adopted by this firm in all their machines. We noticed that, in addition to the usual dividing iron, for separating the portion of corn to be cut from the rest of the crop, a larger number than usual of guard rods are added, for keeping the standing corn clear of the furrow-wheel and platform. When the machine is thrown out of gear for travelling, the platform is turned up vertically on its hinge joint, being secured by a link; and the furrow wheel is removed from the outside of the platform to a supplementary axle bolted on to the frame. The driver's seat, the stem of which has a hexagonal end, is turned inwards in its socket, and the foot-bar similarly disposed of; when thus arranged, the complete reaper will pass through a 4-feet gateway. The firm have lately prepared a diagram showing every part of this machine separately, and bearing its distinguishing number; and, in the event of any part being lost or broken, all that has to be done is to write or telegraph for a part, which is certain to fit on arrival.

RAILWAY SPRINGS.

MANY attempts have been made of late years to reduce friction in railway springs. Amongst other inventions for this purpose may be mentioned Sir Daniel Gooch's plan of putting thin short plates between the layers of laminated springs. In volute and conical volute springs greater care has been taken to make the coils with a fair amount of space between them. But, however accurately these springs are made, it is impossible to entirely get rid of friction between the coils, because the violent work they have to undergo causes the weaker parts to give first, and as the length of compression has to be taken up by a corresponding increase in the circumference of the coils, it follows that the smaller coils increase in size in a greater ratio than the larger ones, and hence friction arises. The most accurately working coiled springs that have been made are what are known as spiral springs, or, accurately speaking, helical springs; but the great difficulty here is that being made from steel of a round or square section, a long range is incompatible with great power, and for the following reasons. Suppose a spring to be coiled as shown in fig. 1, the angle B A C, (*i.e.* the angle at A) represents the angle of repose of the metal.) If the spring is coiled with greater distances in order to give more range between the coils, these distances cannot be maintained in rough work and hence if a spring of greater power is required, the section of steel has to be increased and consequently the range is reduced. Of course by increasing the diameter of the spring the range can be increased in proportion, but its power decreases in proportion as its diameter increases. In some cases the expedient has been adopted of widening the bars, without increasing their thickness, but there are two practical reasons against this plan. The first is that under compression the greatest strain has to be borne by the exterior surface at A A, fig. 2, and it is evident that this strain is much greater in a bar of the shape shown at fig. 2, than in a bar of the shape shown in fig. 1. Hence the temper of such a spring has to be "drawn" more, and the

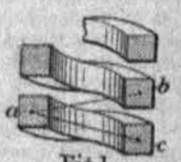

Fig.1.

power is thus reduced. If the extra "drawing" is not resorted to, the spring will not live under violent

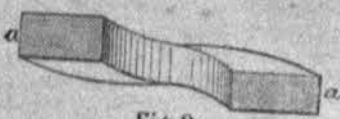

Fig. 2.

shocks. Consequently the extra weight of bar does not give its equivalent in power. The next reason is that it is a matter of the greatest difficulty to make a spring, on this principle, which shall have a correct diagram, such as we shall presently describe, owing to the soft temper necessary.

About five years since, Mr. I. A. Timmis, of 17, Parliament Street, Westminster, designed and patented a new form of bar for making helical and conical spiral springs. The invention broadly consists in having an unequal section-bar, by which means an unequal temper is given to the springs, results being, in the first place, greater power than is obtained in any other springs; and in the second, a greater immunity from breakage under the violent shocks to which railway stock is subjected. These results have been proved by numerous experiments, but, which is of far greater importance—their truth has been successfully established, after several years of working on the principal railways in this kingdom, the colonies, and India. In practice a bar is used of the section shown in fig. 3,

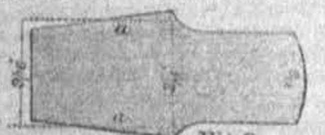

Fig. 3.

in which the dotted lines, *a a*, show the thick part of the bar after coiling. The sides being parallel, the spring does not strain when pressed home. This is not, however, the main point in the invention. The spring having been coiled is hardened in the usual manner, and the temper of the spring has now to be "drawn" or softened sufficiently to enable the spring to resist the violent shocks to which draw, buffer, bearing, and side check or radial axle springs are subject. Supposing the spring were made from a square bar, the bar would have to be softened from the surface to the centre—or, in other words, quite through—and if it were only case-softened it would break under a violent shock. But these springs are softened as though the whole bar were only as thick as the thin part, *w*, fig. 4, the softening

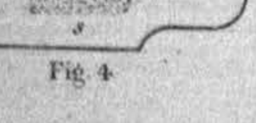

Fig. 4.

process being carried from the surface to half the thickness of the thin part, so that the thick part is only softened to half the thickness of the thin part. The result is that the thick part, *s*, is case-softened and the thin part is wholly softened, and the centre of the thick part, *h*, remains with its carbon crystals in a state of hardness, and has great resisting power, but is prevented from breaking by being protected by the soft thin end. It is well known that under compression the outside of the coil bears the greatest strain. On the other hand, in the case of a safety-valve spring, which often works under tension, the thin web is coiled inwards. These springs are made of various strengths from one ton (of course they can be made of even lighter proportions) up to ten tons of resistance. We have seen a diagram of these springs, and they describe practically a straight line. Further than this, any number of springs tested give the same results, so that in applying these springs as bearing springs under locomotives or other vehicles they ride evenly, which is a very important matter. We understand that the springs are made to any length, and many are now running 22 inches long, with an action of 8 inches, as carriage and truck buffing springs in the centre of the vehicle, the buffer rod running through them. Testimony to their practical value is borne by the fact that they are being used on the leading railways in England, and on many Scotch, Irish, South American, Indian and colonial lines, both on locomotives, carriages and trucks.

With regard to the application of these springs to the latter class of vehicles for buffing purposes we may mention that they are fitted with any amount of range from 2 up to 8 inches, or even more, and we are informed that they are found to be much cheaper and far stronger than laminated indiarubber or volute springs. As draw springs they are made from 2 inches long upwards to fit any existing gearing, and this is a great point for railway engineers to consider, as in changing from one kind of spring to another there is generally a heavy expense incurred, whereas in these springs there is no additional outlay. It is clear that if in fitting draw springs (or buffers) a power can be given to resist the severe shocks of flying shunts, or drawing heavily-laden goods trains, which is said to be from 50 to 100 per cent. greater than that given by indiarubber or other steel springs, the life of the rolling stock must be considerably increased. As showing the economy of these springs, we will give one example in connection with locomotive bearing springs. Supposing there is a load of 12 or 13 tons on the axle, if volute springs are applied it is necessary to put 4 springs over each journal, or 8 springs in all of 28 lb. each, at least, or 224 lb. of metal. But numbers of engines with this weight on the axle are running with only two of the Timmis springs over each journal, or 4 rings in all, 21 lb. each, or 84 lb. of metal, and after several years of working they are found to have taken no permanent set.

All this has been going on for some time, Mr. Timmis having spared no pains to perfect his invention, but having taken no pains to bring it prominently before the public in any way until its practical success was thoroughly established, a wise and most sensible mode of procedure. Mr. Timmis informs us that he is receiving applications for springs of enormous power, and amongst others is one for springs of 15 tons of power each in a group, to take up the shock of barges against dock-gates. One difficulty Mr. Timmis had to contend with at the outset was the manufacturing; but he was fortunate in meeting with willing helps in the firm of Turton Brothers and Matthews, of Sheffield. These gentlemen tried hard for some time to cope with Mr. Timmis' requirements in their old works, but the manufacture of the springs has so greatly increased that the firm have taken new works, and have put down special coiling and testing machines and tempering plant to ensure accuracy in manufacture.

OCCASIONAL NOTES.

THE GROWTH OF GLASGOW.

SINCE the close of her theological and succession troubles, Scotland has increased in population and wealth at a rate only exceeded by America and Australia with the help of an unprecedented immigration. Of this progress Glasgow is a good example. In a work just published, "Old Glasgow," it is stated that a hundred years ago the population of the city was less than 4300; it is now well on to a million. And this growth has been mainly due to the enterprise and industry of the inhabitants themselves. The citizens of London inherited their magnificent river, the men of Glasgow made theirs. A hundred years ago the Clyde was only navigable for small barges; the other day a steamer of 2713 tons sailed up the river and reached her berth at the Broomielaw, in the heart of the city, in three hours from the estuary. During the seven years ending 1877, of the vessels constructed in the United Kingdom nearly half the tonnage was of Clyde-built ships. As an indication of the foreign commerce of Glasgow, it may be stated that no less than 250,000 tons of sugar were imported into the city in 1878, and in the previous year six million pounds of tea. The great iron industries of the Clyde valley have all grown up within the century. This rapid development of commerce and industry out of such small beginnings, and in the face of adverse circumstances, should be taken to heart by the Irish people, who would equally find their account in putting their own shoulders to the wheel instead of sitting down and calling on Hercules.

THE UNITED STATES AND IMMIGRATION.

During the last sixty years the population of the United States has risen from about eight to nearly thirty-four millions, more than the half of which, however, must be taken as the net result of immigration. And this influx of aliens has been marked, year by year, by a steady and usually regular increase. The recent quarterly report of the Chief of the Bureau of Statistics at Washington shows the growth of emigration to the States from 1830 to 1879 inclusive. In the former year the number was only 23,322; in the latter it was 197,954. In the year 1873 alone, the figures rose as high as 473,141. In many years the figures were in excess of those for the year 1879. In every year the estimated number of emigrants from the States was very small as compared with the immigrants who arrived. Last year the excess of immigrants over emigrants was no less than 135,825, and the report states that this is a fair specimen of the years generally. Last month the emigration from the Mersey, chiefly to the United States, was more than double that in the corresponding period of 1879, and a fifth more than in January of the present year. The total number of emigrants was about six thousand, of whom there were bound for the States, 5331, 2911 beivg of English nationality, 36 Scotch and 948 Irish, the remainder being foreigners.

THRIFT.

There are one or two points in Lord Derby's clear, moderate and sensible address at the recent conference at the Mansion House on thrift, which deserve to be particularly noted. There is indeed nothing original or very novel in any of them; but they are usually overlooked. Improvidence is obviously an English vice, because it is a characteristic of the largest class, numbering two thirds of the whole—and the nation, as Mr. Bright once said, lives in the cottage—and of the most prominent, the aristocracy and gentry; the latter sinning in this way from the necessities, or assumed necessities, of their position, and the former from ignorance and in many cases from inability; whilst frugality is indispensable to the trader, surplus capital being the instrument by the use of which he earns his living. His Lordship very cleverly demolished a stock popular argument in favour of reckless dealing with income—that frugality in some way prevents the circulation of money, and is therefore injurious to the community; an objection in which there might be something if savings were kept in a stocking or hid in the thatch, as in old times; but now, as he showed, money is rarely if ever kept idle in that way. It is almost invariably lent out at interest—"it is made to work. It builds railways, it drains the soil, it does a hundred useful things," so that, roughly speaking, "every thousand pounds laid by finds employment for an additional labourer for all time to come." The recommendations with which Lord Derby concluded were horoughly practical. Penny banks in workshops would certainly intercept many shillings that are now worse than wasted in the public house. The Post-office banks should be increased in number, and, as we have ourselves repeatedly advocated, they should be impowered to receive and hold larger deposits than they can at present. The annuity and insurance branches should be similarly extended. The present restrictions are due to the selfish interference of banking and insurance companies, and to the tenderness with which vested interests are dealt with in Parliament, of which the recent transaction with the metropolitan water companies is a notable example. Making easy the investment of small sums in the national securities is another of the modes in which the Government might do the State good service.

ADULTERATION OF FOOD AND DRINK.

The annual report of the Principal of the Laboratory of the Inland Revenue Department has just been issued. Samples of articles the genuineness of which is disputed before the magistrates are occasionally referred to this department, and in several instances these have been declared what they professed to be, in opposition to the conclusions of the public analysts. Duty-paying articles come more directly within the scope of the laboratory chemists; and in one instance, that of methylated spirit, they have found that the revenue and the public are being alike defrauded by the substitution, by druggists, of that description of alcohol for pure unflavoured spirits. Sweetened and mixed with water to disguise its taste, it has also been sold in the streets in some of the large towns of the north of England, by a peripatetic publican. The Principal infers a growing demand for temperance beverages from the number of non-alcoholic drinks that have come under his notice. They are frequently labelled and sold as bitter ale, orange champagne, and so forth; but from the character and flavour of some of them he thinks it unlikely that they will ever come into general use. Perhaps, however, the Principal, like many other people, prefers "summat short" in his diluents. Among the novelties in adulteration mentioned in the report is a "smoking mixture," sold at Birmingham at a cheap rate in packets, which on being examined at the laboratory proved to contain only from 20 to 30 per cent. of tobacco, the remainder consisting of camomile flower heads, with the bitter principle extracted, and dried and sweetened with a solution of logwood and liquorice, an instance of the utilisation of waste products, for the camomile flowers had probably been previously used in the manufacture of a tonic infusion. The big thing in adulteration at the present time is, however, "oleomargarine," a substitute for butter, which, according to a report of the British Consul-General in New York published the other day in a blue-book, is exported from that city at the rate of about 6,000,000 lb. a year. It is sent chiefly to Holland, and there mixed with a certain proportion of milk to give it the proper flavour, colouring ingredients to complete the resemblance to butter, and afterwards churned and converted into "butterine." It is then reshipped, packed in butter tubs, to France and England, chiefly to England, where also, no doubt, a good deal of the French importation ultimately gets, *via* Normandy. The "oleomargarine" is produced by a very nasty process. The raw fat of which it mainly consists having been crushed in a solution of common salt and sulphate of soda, it is slowly heated to 103°, and at the same time mixed with a quantity of the gastric juice from the stomach of a pig, and the rendered fat drawn off. The stearine is then separated, milk or cream added, and the whole carefully cooled. An eminent American analyst asserts that more than 90,000,000 lb. of oleomargarine butter and cheese were manufactured in the United States in 1878, and that he had found living organisms and eggs resembling those of the tapeworm in it. Dr. Piper, another chemist of repute, enters more into detail. He says :—"I have examined a large number of specimens of oleomargarine, and have found in them organic substances in the form of muscular and connective tissues, various fungi, and living organisms which have resisted the action of boiling acetic acid ; also eggs resembling those of the tapeworm. I have them preserved, to be shown to any one who desires to see them. The French patent under which oleomargarine is made requires the use of the stomachs of pigs or sheep. This is probably the way the eggs get in. I have specimens of lean meat taken from oleomargarine. There can be no question that immense amounts of oleomargarine are sold and used as pure butter. I regard it as a dangerous article, and would on no account permit its use in my family."

AGRICULTURAL PROSPECTS.

The Registrar-General's February return shows that the first spring month has been as favourable to the English farmer, both as respects dryness and sunshine, as the previous winter had been in the former condition. A peck of March dust is proverbially reckoned as worth a royal ransom, and so far as the present month has gone the farmer has had no reason to complain. There was in February, indeed, something more than an average rainfall, but the excess was slight over the greater part of the grain-producing area, and it did no harm, but rather good, in consolidating the surface, which had been rendered light and puffy by the combined frost and drought of the winter. The rain fell, too, in the middle of the month, and the drying winds that followed, speedily rendered the land fit for ploughing. A similarly favourable condition prevails in North-west America, according to the latest accounts. In California the agricultural outlook, it is said, has never been better. There has been no excess of moisture, the acreage of cereals is greater than it has ever been before, and there is said to be every appearance that, unless something unexpected occurs, the aggregate crops of the State will greatly exceed those of any previous year.

FORM OF RIVETED JOINTS.*

(*Continued from page* 150.)

IN 1873 a second paper on riveted joints was communicated to the Royal Society by Sir W. Fairbairn, chiefly relating to the relative advantages of punching and drilling. The experiments in this paper show that the shearing resistance of rivets in drilled holes is rather less than that of rivets in punched holes, which appears to be due to the sharp edge of the drilled hole. By definitely rounding the edge of the hole, a greater shearing resistance is obtained than that of rivets in punched holes.

	Shearing resistance of rivet in tons per sq. in.
Rounded holes	21·52
Punched holes	20·95
Drilled holes	19·23

In some experiments made by Mr. Kirkaldy for Mr. Denny in 1879 the rivets sheared at 16·4 tons per sq. in. steel plates.

In a paper communicated by Mr. Barnaby to the Institute of Naval Architects in 1875 some experiments were given, showing that the tenacity of steel plates might be reduced from 31 or 32 to 14½ tons per square inch by the injury done in punching.

In the Transactions of the Royal Irish Academy for 1875 is an extremely interesting paper by Mr. B. B. Stoney on single-riveted joints. The limits of stress obtained are as follows :—

Crushing resistance of bearing surface—	Tons per sq. in.
In the strongest joints	30
Shearing strength—	
Drilled holes, single-riveting ..	18·28
Punched holes, " ..	19·16

In double-riveted joints a somewhat greater shearing resistance was found.

Loss of tenacity in the joints—	Per cent.
In drilled plates, mean loss ..	2
In punched " " " ..	11·45

Some results communicated by Mr. Riley to the Institute of Naval Architects in 1876 showed no loss of strength in bars of Landore steel punched and unannealed.

Mr. Kirk communicated experiments on the effect of punching iron and steel plates to the Institute of Naval Architects, in 1877. These experiments showed that, while punching in all cases diminished the tenacity of iron plates, the loss of strength was much less, when the hole in the die-block was larger than the punch, than when they were of the same size. With steel plates the loss of strength was much greater, but the same influence of the size of hole in die-block was observed.

In the *Engineer* for February 23, 1877, is an account of some interesting experiments by Mr. R. B. Longridge. Unfortunately only "nominal," and not real dimensions of the plates and rivets are given. These experiments tended to show that Fairbairn's estimate of the strength of riveted joints was too high. For single-riveted joints, in which the plates broke, the strength of the joint ranged from 38·9 to 40·7 per cent. of the strength of solid plate when the plates were unannealed, and was 45·7 per cent. in an annealed plate. In joints in which the rivets sheared, the strength ranged from 39 to 44 per cent of the strength of the solid plate, one joint giving (unless there is a misprint) 50·6 per cent. In some experiments in which the plates are described as "breaking joint" the percentage was higher. In experiments with double-riveted lap joints, all gave way by tearing the plates except two. The joint had from 54·5 to 66·1 per cent. of the strength of solid plate. With single-riveted butt joints, all gave way by tearing the plates, and the strength was from 51·5 to 58·5 per cent. of that of solid plate. With double-riveted butt joints, all but one gave way by tearing the plates, and the strength was from 61·6 to 67 per cent. of that of solid plate. It is stated that chain riveting proved to be stronger than zigzag riveting, but it is not quite clear from the Tables how this result is arrived at.

Experiments relative to steel boilers were communicated by Mr. Boyd to the Institution of Mechanical Engineers in 1878. In two of the experiments here given it appeared that punching diminished the tenacity of steel plates by 35 and 51 per cent., while drilling reduced it only 2 per cent. Annealing appeared to restore the strength of the punched plates. In the discussion on this paper Dr. Siemens mentioned experiments on punched steel plates in which the strength appeared to be increased by punching, and spoke of the helical punch as likely to diminish the liability to injure the plate in punching. This was confirmed by experiments given by Mr. Tweddell.

An extensive series of experiments is contained in a paper by Mr. Martell on steel for shipbuilding, in the Transactions of the Institute of Naval Architects for 1878. The mean values of the breaking stress in these experiments were as follows :—

	Tons per sq. in.
Iron plates, tearing in line of rivet holes, holes punched..	17·9
Iron rivets in steel plates, double chain riveted, sheared at	16·7
Iron rivets in steel plates, the rivets being zigzag, sheared at..	19·2
Steel plates with punched holes and steel rivets, not annealed, gave way by tearing the plates or shearing the rivets at ..	22·5

With thin steel plates the injury due to punching appeared to be less than with iron plates. In the case of plates above $\frac{8}{10}$ inch thick the loss of strength due to punching was 20 to 23 per cent. for iron, and 20 to 33 per cent for steel. By annealing the lost strength was restored Steel was injured for a very small distance round the hole, so that by rimering out an annulus of metal ⅛ to $\frac{1}{16}$ inch thick the injured part was removed. In drilled plates there was no appreciable loss of strength. Plates punched with a spiral punch were 2½ tons per square inch stronger than when punched with an ordinary punch.

The most careful examination of the way in which punching injures plates has been made by M. Barba, whose experiments are described in a Treatise on the Use of Steel (1875). M. Barba shows that when a punched bar is broken by tensile stress, the width of the bar, relatively to the diameter of the hole, influences the apparent tenacity. The tenacity diminishes in these experiments as the width of the bar for a given diameter of hole increases. From this he infers that the loss of tenacity is not due to any cracking produced by the punch, or to a reduction of tenacity in the neighbourhood of the hole. The effect of punching is to alter the elasticity, or to diminish the power of elongating in a narrow annulus round the hole. This causes an unequal distribution of stress, and fracture begins at the rivet-hole. By removing an annulus 0·04 inch thick round the hole the effect of punching is neutralised. With iron and steel plates similar results were obtained.

The Committee have received a copy of a Report by Mr. W. Parker and Mr. John, made in 1878 to Lloyd's Committee, on the effect of punching and drilling. The experiments on which this Report is based were made at the Chain Testing Works at Saltney. These experiments showed that thin steel plates lost comparatively little from punching, but that in thick plates the loss was very considerable. The following Table gives the results for plates punched and not annealed or rimered :—

Thickness of plates.	Material of plates.	Loss of tenacity per cent.
[illegible]	Steel	8
[illegible]	"	18
[illegible]	"	26
and [illegible]	"	33
[illegible]	Iron	18 to 23

The effect of increasing the size of the hole in the die-block is shown in the following Table :—

Total taper of hole in plate inches.	Material of plates.	Loss of tenacity due to punching per cent.
1-16	Steel	17·8
[illegible]	"	12·3
[illegible]	"	24·5
	(Hole ragged)	

The plates were from 0·675 to 0·712 inch thick.

It was observed that the effect of punching was not only to reduce the tenacity, but also to diminish the elongation before fracture, and to cause the fracture to become crystalline instead of silky. This is quite accordant with Barba's views. When ⅞-inch punched holes were rimered out to 1⅛ inch diameter, the loss of tenacity disappeared, and the plates carried as high a stress as drilled plates. Annealing also restores to punched plates the original tenacity. Some of these experiments are given in a paper read before the Institute of Naval Architects in 1878.

Mr. D. Adamson has found that, while a series of small holes in a bar does not diminish but rather increases the tenacity of the metal left, a large hole may cause a serious reduction of strength particularly with material which elongates little under strain. This Mr. Adamson explains as due to the interruption of the lines of force by the presence of the hole. The following results obtained by him, are more conveniently given here than later :—

	Apparent tenacity in tons per square inch.	
1. Solid plate	29·46	All of the same material.
2. One hole	27·00	
3. One hole with turned pin driven in	28·57	
4. Two smaller holes	29·01	
5. Two holes (broke in solid part of plate)	63·70	
6. Iron tested across the grain, one hole (broke through hole)	17·41	The same material.
7. The same. Two smaller holes (broke in solid part of plate).. ..	19·64	
8. Steel (same material as in 1), one large hole	27·522	The same material.
9. The same. Two smaller holes..	30·357	
10. Solid plate	58·704	All of the same material.
11. One hole	56·941	
12. Two smaller holes	65·624	

In a paper communicated to the Iron and Steel Institute 1879, Mr. Barnaby has given a series of experiments specially intended to determine the influence of punching on iron and steel. He has found that iron suffers more in punching when the holes are near the edge than when further removed ; but in mild steel the material suffers less when the hole is one diameter from the edge than when so distant that there is no bulging of the edge. Specimens were prepared with two holes punched in each, and these were shaped in the slotting machine so that the distance of the holes from the edge should always be one rivet diameter, and the pitch between the holes that usual in ship riveting. In some cases the bar was shaped to the required width before punching. In others the holes were punched and the plate shaped afterwards. In the latter case the bulging of the edge of the plate during punching was prevented by the distance of the hole from the side of the plate.

	Apparent tenacity. Tons per sq. in.		
	Unpunched plate	Punched before shaping	Punched after shaping.
Open hearth steel	27·6 ..	23·7 ..	24·5
Converter steel	27·5 ..	21·7 ..	24·8
Best best iron	21·5 ..	19·0 ..	17·7

The following experiments were on plates above ½ inch thick, butt jointed and treble riveted :—

	Apparent tenacity. Tons per sq. in.	
	Annealed.	Not annealed.
Countersunk points—		
Open hearth steel	30·6 ..	29·84
Converter steel ..	30·2 ..	21·80
Best best iron ..	— ..	19·90
Snap points—		
Open hearth steel	28·6 ..	21·20
Converter steel ..	26·9 ..	15·25
Best best iron ..	— ..	18·30

The countersinking was not carried through the plate, so that a part of the metal strained in punching was left. Comparing the tenacities with those of solid unpunched plates in the previous table, a gain of strength for the riveted joints is in some cases observed. This Mr. Barnaby ascribes to the friction of the riveted joint. To get rid completely of the injury done in punching, Mr. Barnaby proposes in future to punch the holes ⅛ inch less in diameter than the rivet, and to enlarge the hole when countersinking. Snap riveting is only employed by him for subordinate parts.

It may be presumed that the low apparent tenacity with unannealed plates and snap points is due to the amount of injuring metal being greater than with countersunk points. But it is not obvious why the tenacity with annealed plates is less for snap than for countersunk points.

An exceedingly complete and extensive series of experiments on riveting is described in a paper by Mr. David Greig and Mr. Max Eyth, read before the Institution of Mechanical Engineers while this report was in preparation. The first experiments related to Taylor's Yorkshire rivet iron, and to Brown and Co.'s mild rivet steel. The tensile strength of the iron was 22·2 tons per square inch, and of the steel 28·8 tons per square inch. The shearing resistance of the iron was 19 tons, and that of the steel 22·1 tons. Some plates riveted together were then tested, and a somewhat higher shearing resistance was found than for bars not formed into rivets. This is ascribed partly to the rivet being increased in diamater to fill a hole larger than its normal size, partly to the friction of the plates. Experiments on the effect of the riveting pressure on the strength of the rivet seemed to show some increase of resistance as the pressure is greater. This may be due to friction, but the matter requires further investigation. The hardening of the rivet is a possible cause of increased resistance of rivets as compared with simple bars, as well as the friction of the plates.

Experiments were made on riveted joints, the plates being ⅝ in. thick, the rivets ⅝ in. diam., and the holes drilled $\frac{11}{16}$ in. diameter. Solid plates broke with a mean resistance as follows :—

Cammell's iron	22·29	tons per sq. in.
Brown's iron	22·26	"
Mean ..	22·27	"
Cammell's steel	25·49	"
Brown's steel	26·18	"
Mean ..	25·83	"

Experiments on lap joints with punched and drilled holes showed that with drilled iron plates the apparent tenacity of the plates was only 84·1 per cent. of that of undrilled plates, while the apparent shearing resistance of the rivets was 103 per cent. of the resistance of the rivet iron. The punched iron plates gave way with an apparent tenacity 75·5 per cent. of that of the unpunched plate. The steel joints all gave way by shearing the rivets, the shearing resistance for drilled holes being 108 per cent. of the shearing resistance of the steel bar as given above, and that for punched holes being 115 per cent. This confirms Fairbairn's experiments as to the greater strength of rivets in punched holes.

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* Reports to Research Committees of the Institution of Mechanical Engineers.

Twelve lap joints riveted in different ways gave the following results:—

	Ratio of strength of joint to that of solid plate.	Ratio of apparent tenacity to tenacity of plate.
Hand riveted, iron joints	·465	·825
Hydraulic riveted, iron joints	·539	·896
Steam riveted, iron joints	·509	·846

All the steel joints gave way by shearing the rivets, the seam being 49, 58, and 54 per cent. of the strength of solid plate, with hand, steam and hydraulic riveting. The apparent shearing resistance was 95, 112, 107 per cent. of the shearing resistance of the rivet steel tested as a bar.

Specimens of iron lap joints with ¾ instead of ⅝ in. rivets, gave a somewhat greater resistance, the joint having 57·6 per cent of the strength of solid plate.

Double-riveted lap joints were then tested. Iron joints, which broke by tearing the plates or shearing the rivets, had 65 per cent. of the strength of solid plate. Steel specimens broke by shearing the rivets, the strength of the joint being 70 per cent. of that of the solid plate.

Single-riveted butt joints of iron gave way at a strain equal to 47 per cent. of that which would have broken solid plate. The strength is about the same as that of single-riveted lap joints, as might be expected. The steel joints had 56 per cent. of the strength of solid plate and gave way by shearing as before. Double-riveted butt joints also gave nearly the same results as double-riveted lap joints. Butt joints with double covers gave a somewhat higher resistance, which is attributed to the less bending of the plates and to the greater friction between them. It is however very difficult to see that the friction can affect the tenacity of joints which give way as those did by tearing the plates. The strength of these seams was from 60 to 68 per cent. of that of solid plate.

Experiments are then given on the strength of stayed surfaces and of riveted boilers tested by hydraulic pressure. In these latter the seams began to leak at a comparatively moderate pressure, and the pumping power was inadequate to raise the pressure to anything like the bursting pressure of the boiler. In steam-boiler explosions the action is too sudden for such a relief of pressure by leakage to occur.

(To be continued.)

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

MANCHESTER SCIENTIFIC AND MECHANICAL SOCIETY.

Automatic Valve-Gear for Rolling-Mill Engines.

At the ordinary meeting of the members of the Manchester Scientific and Mechanical Society, held on Friday last, Mr. I. Bowes, president, in the chair, a paper was read by Mr. C. Bollé, on "The Application of Automatic Valve-Gear to Rolling-Mill Engines." In the course of his paper the writer observed that when they considered that the prosperity of England depended greatly upon the flourishing condition of its industries, they must admit that every circumstance affecting any branch of the trade was not only of importance to the manufacturer engaged in it, but also to the nation in general. As long as the manufacture of iron was in its infancy in other countries, while already largely developed in England, economy in producing the goods was of little importance, as the other countries were unable to supply their own requirements, and obliged to buy from England at whatever prices ruled here. But at the present time several countries, notably Belgium, Germany and America, were in a position not only to meet their inland demand, but also to compete with us in foreign markets, and when they saw Belgian ironwork brought even to Manchester in consequence of its price being lower than English makers would accept, they must admit that the question of of economy in production became very important indeed. It was not his intention to enter upon the question of economy generally, but only in respect to one branch of the iron trade, the manufacture of rolled iron, and to confine himself to one point connected therewith, the economical use of steam. The economical conversion of pig-iron into rolled bars or plates of iron or steel depended, firstly, upon the construction of the furnaces and appliances for converting the pig-iron into balls or ingots; and secondly, upon the machinery employed for rolling the balls and ingots into bars, rails, or plates. As regarded the former, great progress had been made during late years, and it might be said that manufacturers, as a rule, were alive to the importance of any improvements in that part of their plant. For rolling the iron the machinery consisted of two parts, the rolls themselves, and the machine for driving them. The greatest economy would be obtained if the rolls were so constructed that they did their work with the least amount of motive power, and if the motor were constructed so as to produce this power at the least possible cost. The amount of power required by rolls for a certain class of work depended upon the proportions of the rolls themselves, and on the frictional resistance in the bearings and wheels. More attention had lately been paid to the construction of the housings and bearings, especially to arrangements for maintaining the bearings true with each other, and considering the heavy pressure on the roll journals, too much attention could not be paid to this point. As regarded the economical proportions of the rolls for a certain class of work, he was afraid we were still very much in the dark; certain diameters of rolls and series of grooves, having been found to answer in practice, were adhered to, but whether others might not produce the same result with a less expenditure of power was a point which still required elucidation. It would be necessary for this purpose that indication diagrams should be taken from a large variety of rolls doing the same work; but, unfortunately, reliable diagrams could hardly be obtained from the existing rolling-mill engineers, and the settlement of the question would have to be deferred to some future date. The motor driving the rolls was usually a steam-engine, and he should confine the remainder of his paper to the consideration of that class of motors. It might at once be asserted that the most economical steam-engine used for any other purpose would also be the most economical engine for rolling mills. It was well known that the greatest economy was obtained by using high pressures of steam, and a large degree of expansion, regulated automatically by means of a governor, instead of working with a fixed amount of expansion and throttling the steam before admission to the cylinder. How far these arrangements were applicable to rolling mills remained to be examined. In their general type and arrangement the engines used in ironworks had followed the development of the steam-engine employed in other works. He was himself in favour of every possible simplicity, but he thought even this might be carried too far, and efficiency and economy ought not to be sacrificed to it. He did not think it was necessary that an engine in such works should be so simple that any labourer could attend to it; and there was no reason educible against some complication of the mechanism so long as a good mechanic or engineer could master it and keep it in order. To derive the greatest profit from the employment of expansion-gear, it was necessary that it should be controlled directly by the governor, so as to admit only so much steam as was required for the actual work done; and he would now proceed to consider how far it was possible to employ automatic expansion engines in rolling mills, and which kind of gear was the most suitable for that purpose. Of course, there were objections raised against the employment of such gears in rolling mills; but he maintained that the assistance of the engineer for regulating the admission of the steam was only to be retained where very large variations in the power necessary occurred at low speeds—as, for instance, in rolling heavy plates. In this case, however, a governor might still be employed if a sliding weight were arranged on the governor lever, which the engineer could easily move by hand. The application of automatic gear to mill engines being proved to be practicable, the next consideration was, the most suitable of the various kinds of gear. These might be divided into four classes—the slide-valve, piston-valve, Corliss, and double-beat or equilibrium-valve gears. The slide-valve expansion gears were the simplest in construction and most readily understood by the persons in charge of the engines, and he considered them preferable to any others up to a certain size of engine, but when they came to large engines the adoption of a different kind of valve gear became advisable from an economical point of view. Next to the slide-valves stood the piston valves in point of simplicity. They formed a natural equilibrium slide, but, on the other hand, did not possess the advantage of the flat slides of remaining steam-tight even after considerable wear by the pressure of steam on their back. Piston valves had been used with advantage in vertical positions, but when in horizontal positions they soon became leaky. They were also badly adapted for the application of the most perfect automatic gear. The Corliss valve was undoubtedly one of the most perfect automatic gears. It was frequently used in America for ironworks purposes, and an engine of that class had been erected at Crewe for driving a new rail mill. He would, however, question whether this class of gear was particularly suitable for ironworks, its mechanism, in his opinion, being too delicate for the place. The equilibrium valve gears were of an ancient date, and were largely used for all sorts of factories, winding, blowing and pumping engines. They were also used in a less degree in mill engines with very good results, and the objection that it was unsuitable for high speeds was scarcely tenable when they could see a large engine actually running at seventy revolutions per minute. Mr. Bollé, in closing his paper, summed up the conclusions arrived at as follows:—(1) Economy in steam was essential for the profitable working of rolling mills, and could best be obtained by using automatic expansion gears; (2) such gears could be, and had been, applied to mill engines; (3) for smaller engines flat slide-valve gears were suitable, for large ones double-beat or equilibrium valve gear; (4) The economy in steam was increased by the use of condensers, and in connection therewith of compound engines where coal was dear; (5) Clutch reversing engines were to be preferred to coupled reversing engines without fly-wheel; (6) In laying out new works a high steam-pressure ought to be adopted. In bringing the subject before the Society, he wished specially to point out what stage the question was in amongst their Continental competitors, so that any member connected with the iron trade might see that our rivals were fully alive to any economies obtainable in the manufacture of iron, and that it behoved us to watch every point therein as sharply as possible, in order to maintain our leading position.

The reading of the paper was followed by a discussion, in which the members generally concurred in the suggestions made by the author, and the president thought that if the principle could only be applied to steam rolling mills, it would effect a great saving.

CLEVELAND INSTITUTION OF ENGINEERS.

At a meeting of the Cleveland Institution of Engineers in the Literary and Philosophical Society's Hall, Middlesborough, on Monday evening, a paper by Mr. G. Barrow, F.G.S., on the resources of the Cleveland ironstone was read by the Institution Secretary (Mr. Angus Macpherson), Mr. Barrow being unable to be present. Mr. Gjers, the President, occupied the chair.

In the commencement of his paper, Mr. Barrow remarked that there were two distinct classes of stone in Cleveland, the better being blue, very oolitic, comparatively free from aluminous matter, and yielding about 30 per cent., or rather more, of iron; while the second class was of a dull, yellowish tinge, not so oolitic, and contained alumina in place of iron, 28 or 29 per cent. being as much iron as could be got out of it. This deterioration in the quality of the stone was accompanied by a serious drawback to its being cheaply worked, for towards the middle of the seam a band of shale gradually came in, thickening in a southerly direction till it reached its maximum thickness of 2 feet in the main seam, as in the district of Grosmont, where the seam was not workable. The limit of the shale band in the middle of the seam might be roughly described by a line joining the road at Spa Wood, near Guisborough, to the north side of South Skelton Shaft, thence to Hammersea, on the coast, a little more than a mile from Skinningrove Beck. All the good stone was north of that line. It was at Eston, Upleatham, and in the Skelton and Huntcliffe district. He calculated the seam as being one foot in thickness. At Eston there were 24,000 acres, or 86,400,000 tons of stone; at Normanby, 2300 acres, or 8,300,000 tons; at Ormesby, 720 acres, or 2,600,000 tons; at Dimsdale, 900 acres, or 3,250,000 tons. Taking the output as at present, Eston would be exhausted in seventy-five years, Normanby in eight years, and Ormesby in fifteen years. In the Upleatham district there were 10,000 acres, or 36,100,000 tons. The duration would be between twenty-five and thirty years. The area of good stone left in Skelton and Huntcliffe was 48,000 acres, or 173,000,000 tons, which at the present output would take eighty years to exhaust, but, considering the increased demand which might be expected thirty years hence, sixty years was a fair limit. The main seam in the poorer districts might be said to consist of a strip thirteen miles long and about two and a half miles wide. The seam was very poor; there were four feet of stone, with two feet of shale parting in the middle. Before it would pay to work this seam the other seams would have to be wrought. The total amount which it would pay to work in fairly good times might be roughly estimated at 375,000,000 tons, and at the present rate of output it would take 130 years to exhaust it. But it was only fair to surmise that the output would be considerably increased at the end of thirty years, when the Upleatham and other mines were exhausted.

On the motion of the chairman, a vote of thanks was passed in acknowledgment of the paper.

Yorkshire College.—The ceremonial opening of the new buildings at Beech Grove has been deferred until after the general election, and will, therefore, not take place on the date previously announced—viz., April 13th. The work of the textile industries and dyeing departments will not, however, be postponed for the public ceremony, but will begin in the new buildings on the first day of the third term—viz., on the 13th of April.

The York Industrial Exhibition.—The report of the Executive Committee of the Yorkshire Fine Arts and Industrial Exhibition recently held at York has been issued. It states that the Exhibition was visited by about 550,000 persons, from whom £17,336 was received. The total receipts, including a surplus of £2315 from the Exhibition of 1866, amounted to £34,540. The gross expenditure was £33,184, leaving a balance in hand of £1356.

Congress of German Economists.—The next congress of German economists will meet on the 21st of September, at Berlin, and the sittings will continue till the 24th. The Commercial Treaty with Austria; international uniformity in Customs duties; the position of German iron manufacturers and the duties on iron; international movements of the precious metals; emigration and colonisation, are among the leading questions set down for discussion at the meeting.

Industrial Exhibition in Styria.—Information has been received from the commercial department of the Austrian Embassy that a provincial exhibition will be opened at Gratz, Styria, in September next, embracing the following classes:—Culture of land and forests, mining and metallurgy, industry and trades, art and industries connected therewith, science and public instruction. Home and foreign standard goods and objects will be admitted, and medals, diplomas and money prizes will be awarded. A public auction will be held at the close of the exhibition of all such goods as are entered by the exhibitors on the list opened for this purpose. Applications for space must be made before the 30th of April, 1880. All inquiries and communications may be directed to the General Committee of the Provincial Exhibition at Gratz, who will furnish detailed programmes and all particulars.

Pneumatic Clocks at Paris.—Paris is getting the start of other capitals as regards public clocks, the municipality having contracted with the Pneumatic Clock Company for the erection of a number of clocks in the principal thoroughfares. Each clock consists of two opaque glass dials, with a hollow space between in which a gas-burner is lit at night, so that the time can be seen by persons approaching in either direction. The hands are moved at an interval of a minute by means of pneumatic tubes, the air being pumped in by a six-horse power engine. Observatory time is of course given, and the company offer to lay tubes to private houses. The principle is that of an Austrian firm, Popp and Hirsch, and it will have to compete with the electric clocks used at the railway stations. One objection will, perhaps be taken to it—viz., that it does not indicate fractions of minutes.

Luminous Paint.—At a meeting of the Society of Arts on Thursday night last week Professor Heiton, of Charing-cross Hospital, gave a lecture on "Balmain's Luminous Paint." He commenced by stating the nature of fluorescent substances, showing examples of several under the electric light. Afterwards he alluded to phosphorescence and detailed the history of the investigation of phosphorescences. Bacquerel, a Frenchman who lived about thirty years ago, discovered more than all the other investigators together, and Balmain, the inventor of luminous paint, had the advantage of studying at one time under him. The paint is made up either as an oil or water colour, and its sensitiveness to light is such that, as was shown by experiment, a piece of painted cardboard exposed to the sparks of an induction coil shows in the dark a photographic record of the sparks. On being exposed to light under different coloured glasses the paint displayed hardly any luminosity excepting when under blue glass. This proves that it is the actinic rays, as in photography, which affect the paint. Red rays, indeed, destroy the light, but it was shown that this is due to the heat developed over-stimulating and exhausting it. A can of hot water had the same effect as red rays of light. Exposure to air or water does not affect the paint, and a painted-model life-buoy was shown which when placed in a jar of water retained its brightness. The lecturer stated that the paint was efficiently bright in the dark until from eight to ten hours after the time when it had been exposed to light. He illustrated its practical utility in various ways, one illustration being a diver who walked into the darkened room with his dress covered with the paint which gave him a very phantom-like appearance. It was mentioned that at Southampton Docks the divers had found the emitted light to be of much service under water. Professor Huxley, who presided, complimented the lecturer for his lucid explanation of the scientific as well as practical character of the paint. Mr. Balmain, he said, had been his intimate friend, and his name was remembered by all who knew him with veneration and affection. All felt his untimely death just at the moment when his patient researches commenced to bear fruit. In the discussion which followed it was suggested that a good use for the paint would be to paint shop-window shutters and street vehicles with it. Two railway companies had experimented with it for painting carriages running through tunnels and these experiments had been very favourable. A vote of thanks was passed to Professor Heiton for his lecture.

GEMS.—On Thursday evening last week, Mr. E. J. Watherston, F.S.S., in lecturing at the London Institution on "Gems and Precious Stones," said that, with the exception of the diamond in the glass-cutter's hands, they were intrinsically worthless, their high estimation in ancient times having been due to their use as magical charms against all sorts of evils, especially as warding off diseases, while in later ages they were mainly prized as concentrated expressions of wealth and splendour. Having traced the working of these various ideas from the dawn of civilisation to our own days, he observed that, strictly speaking the term "precious" was now generally limited to about half-a-dozen gems, the rest passing muster as "half-precious." The diamond, of course, headed the list now, as of old, although the ruby might at times be more highly prized. The Braganza, in the possession of the Crown of Portugal, was generally set down as the largest known diamond. It was still in the rough, in which state it weighed 1680 carats, and had been appraised at 58 millions sterling. It was of the size of a hen's egg, and was taken from a Brazilian mine in 1741. Some good judges who had been allowed by the jealous Portuguese Court to examine it had pronounced it a white topaz, so that the diamond belonging to the Rajah of Mattan, which was less than one-fourth the weight of the Braganza, stood first on the undisputed list. A Dutch Governor of Batavia was said to have offered half a million sterling for it, but was met by the Rajah with a blank refusal, on the ground that his diamond was "a talisman upon whose possession depended, not only his own happiness and success, but that of his whole family." The Nizam's diamond, and the problematical Agrah, which Tavernier, in the 17th century, said he saw, but which nobody had seen since, closed the list of diamonds weighing over 300 carats. The other famous diamonds spoken of were what Tavernier named, from its shape, the Great Table; the Regent, also called the Pitt; the Orloff; the Star of the South; and the Koh-i-noor. The account of this last, the most precious jewel in the regalia of the English crown, was naturally the most detailed. The lecturer agreed with those who identify it with that named after the Great Mogul, which in its original state weighed no less than 787 carats, but by successive cuttings, each, he thought, more or less injudicious, had been pared down to 102. The lecturer spoke slightingly of the prospect of the artificial production of diamonds. Of rubies scarcely more than two merited mention as historical. The first and most famous of existing rubies was that which forms part of the Imperial State Crown made for Queen Victoria in 1838. It was believed, on tolerably good authority, to have been worn in front of the helmet of Henry V. at Agincourt. Its history could be traced back to 1367, when King Pedro, of Castile, presented it to the Black Prince. Its estimated value was half a million sterling.

MEETINGS FOR THE WEEK.

MONDAY, MARCH 22.

SOUTH KENSINGTON MUSEUM.—8 p.m. Professor G. Barff, on Colour and Pigments in Relation to Painting.

ROYAL SCHOOL OF MINES.—8 p.m. Professor Huxley, on Dogs and their Forefathers.

ROYAL GEOGRAPHICAL SOCIETY.—8.30 p.m. Mr. E. Hutchinson, an Ascent of the River Binué in August, 1879, with remarks on the Systems of the Rivers Shari and Binué.

TUESDAY, MARCH 23.

INSTITUTION OF CIVIL ENGINEERS.—8 p.m. Mr. F. A. Abel, C.B., F.R.S., on Explosive Agents applied to Industrial Purposes.

ROYAL COLONIAL INSTITUTE.—8 p.m. Sir Arthur Blyth, K.C.M.G., on South Australia, her Land Laws and Recent Industrial Progress.

BRITISH HOROLOGICAL INSTITUTE.—Mr. R. Strachan, F.M.S., on International Weather Service.

WEDNESDAY, MARCH 24.

GEOLOGICAL SOCIETY.—8 p.m. 1. Mr. Searles V. Wood, on the Newer Pliocene Period in England. 2. Mr. G. R. Vine, A Review of the Family Diastoporidæ for the purpose of Classification.

HUNTERIAN SOCIETY.—8 p.m.

SOCIETY OF TELEGRAPH ENGINEERS.—8 p.m.

THURSDAY, MARCH 25.

INVENTORS' INSTITUTE.—8.15 p.m.

FRIDAY, MARCH 26.

GOOD FRIDAY.

METALLURGY AND MINING.

IRON MINING ON THE WEST COAST.—Considerable additions have been made to the rolling stock of iron miners and smelters on the West Coast, owing to the considerable development of the iron trade during the past ten months.

SEARCH FOR COAL IN CUMBERLAND.—Boring operations for coal were commenced last week on Mr. Postlethwaite's Hollier's estate, Hensingham, near Whitehaven, in a field adjoining the Furness Railway, where there are evidences of a considerable tonnage of coal.

MINE MANAGERS.—At a meeting of the Board of Examinations for the eastern district of Scotland was held in Edinburgh on Tuesday, at which it was resolved that after next examination no candidate be admitted who is under twenty-two years of age, and also that they be required to have more practical experience in the working of collieries before they be considered eligible for certificates of competency as mine managers. The next examination will be held in Edinburgh about the end of May.

AUSTRALIAN GOLD.—The *Melbourne Argus* estimates the yield of gold in the colony of Victoria in the year 1879 at a little over 712,000 oz., being nearly 39,000 oz. less than in 1878, and being also less than half the quantity obtained in 1868. The *Argus* adds:—"It is well known that the yields of gold during the latter half of 1879 were much superior to those of the first half, and if mining should continue during 1880 as it has recently been, it is probable that the yield for it will exceed that of the year just closed." The amount of gold coin issued from the Melbourne Mint in 1879 was 703,709 oz., the value of which was £2,740,000.

INCREASED OUTPUT OF HEMATITE IRON ORE.—On all hands there are indications of an increased output of iron ore throughout the Furness and Cumberland districts, the improvement in the demand having necessitated an increased supply. The Gillfoot Park Company, near Egremont are opening a new iron ore pit, and one already in operation is producing a large quantity of metal. The Carron Iron Company are making preparations to work an old pit at Jacktrees which was formerly owned by Messrs. Lindow. Lord Leconfield has opened a new pit at Cleator Moor which is producing a large tonnage of iron. The Cleator Iron Company have recently completed the working of their No. 6 pit. The Maryport Iron Company are preparing to sink a shaft for iron ore at Gutterby, while at Woodend Messrs. Lindow struck one some time ago and are now sinking a new pit.

RAILWAYS & TRAMWAYS.

THE ST. GOTHARD TUNNEL.—The total length of the St. Gothard Tunnel is 14,920 metres, or 112 feet more than 9¼ miles. Its width is 6½ metres, or 21¼ feet. The undertaking has required for its execution seven years and five months—four and a-half years less than the time taken to complete the Mont Cenis Tunnel. The average daily progress was 5½ metres, or 18 feet. The number of holes bored amounted to 320,000, and 490,000 kilogrammes of dynamite were used in blasting. One million six hundred and fifty thousand drills were consumed, and 1,450,000 cart-loads of *debris* were taken from the mountain.

EAST LONDON RAILWAY.—The necessary arrangements have been completed for establishing the connection between the East London Railway and the Mid-Kent and North Kent lines of the South-Eastern Railway at New Cross; and that, commencing on the 1st of April next, a convenient first, second, and third class service of trains will run between Croydon, Addiscombe Road, and Liverpool Street—the trains calling, of course, at the respective intermediate stations. The opening of this new communication with the City and East End of London will, moreover, afford the necessary facilities for traffic passing to and from Blackheath, Woolwich, Maidstone, Dover, Folkestone, Tunbridge Wells, Hastings, Canterbury, Ramsgate, Margate, and other places south of the Thames served by the South-Eastern Railway.

AN ELECTRIC RAILWAY.—The council of magistrates of the city of Berlin had under consideration a few days ago a proposal, submitted by the firm of Siemens and Halske, for the construction of an electric railway across a portion of the capital. The line would start from the Belle Alliance Place, and run through Friedrich and Chaussee Streets on to the Wedding Place. There will be two lines of rails, one for the up and the other for the down journey. The viaduct will be carried on iron pillars 14 feet 9 inches high, and nearly 33 feet apart. These pillars will be placed along the edge of the footpath, so as to cause the least possible interference with the ordinary traffic. The carriages will be narrow and short, containing ten sitting places and four standing places. The electro-dynamic machine which will propel the carriages will be placed under the floor of the carriage between the wheels, and a steam engine of 60-horse power, which will be employed in the production of the electricity, will be placed at the terminus. The stoppages will be very few, and the rate of speed will be, it is expected, about twenty miles an hour. The chief object of the undertaking is to convey persons quickly across the city, and especially to facilitate access to the city line of railway. The chief objection raised is that the carriages will pass along at the level of the first floor of the houses in the streets which it will traverse, and it is feared this will lead to a depreciation of property. The magistrates have appointed a special commission of engineers and architects to examine into and report upon the proposal.

ELECTRICITY, TELEGRAPHY

THE DIRECT SPANISH CABLE.—Direct communication with Spain *via.* Bilboa by this line has been fully restored.

SHEFFIELD TELEPHONE EXCHANGE COMPANY.—It is stated that the Sheffield Telephone Exchange Company intend applying to the Corporation for permission to fix in the immediate vicinity of one of the central cab stands a small signal-box, so that subscribers may be able to call a cab or hansom at any moment, either from their place of business or their dwelling.

THE ELECTRIC LIGHT AT THE BRITISH MUSEUM.—It is understood that the Trustees of the British Museum have resolved upon permanently adopting the Siemens system of lighting by electricity, which has been in temporary use in the reading room for some months. In order to provide greater security against any sparks of carbon that might fall, a glass tray has been placed under the lamps. The great increase in the number of hours during which readers have been enabled to avail themselves of the Museum has given great satisfaction and been widely appreciated.

THE DYNAMO-ELECTRIC MACHINE.—The last Friday evening lecture was given by Dr. Siemens on the various applications of the dynamo-electric machine. He commenced with a reference to Faraday's great discovery of the magneto-electric induced current first brought under the notice of members of the Royal Institution in 1831. From *a priori* reasoning Faraday had seven years previously concluded that such currents must exist, but with the apparatus then at his command he could not detect them. The utilisation of the induced current was a work of much time and thought on the part of those who followed in the wake of the discoverer. Wheatstone, in 1844, made one of the first attempts to utilise it in telegraphy, but the currents were found insufficient to move the receiving instrument with certainty. Dr. Warner Siemens, in 1856, arranged a magneto-electric "step-by-step" instrument. The first machine on the dynamo-electric principle invented by the lecturer, was explained by him to the Royal Society in 1867. This machine differed from magneto-electric arrangements in the substitution of electro magnets for permanent or steel magnets. The electro magnets were excited by the current produced by the armature of the machine itself. Rotation might be produced by steam, hand or water power, and the power was available by wire at a distance of twenty or thirty miles.

THE TELEPHONE AND TELEGRAPH.—The firm of Connelly Bros. and McTighe, patent attorneys, Pittsburgh, says the *American Manufacturer*, have recently applied for patents for two inventions of their own, which, if equal to what is claimed for them, will doubtless be of great benefit to the world. The first is a device in connection with the telephone which enables parties desiring to communicate privately with each other to disconnect themselves from the central office at will. The claim made for the second invention is the ability to transmit the physical wave force of light electrically, similar to the transmission of sound by the telephone. It is claimed by the inventors that when the invention is sufficiently perfected for practical use it will be possible for one or two persons conversing by telephone to perceive distinctly at the same time the image of the person with whom he is communicating. The inventors also believe that they will be able by this invention to transmit instantaneously from point to point any written or printed document—as, for instance, the entire side of a newspaper. But a single wire is required, and the image of any object, however large, may, it is claimed, be transmitted, which, while sent in diminutive size, is magnified at the receiving point, before its reproduction, to the required size. Mr. McTighe, who resides in this city—his partner living in Washington, D. C.—states that by his experiments he has been able to reproduce clearly and faithfully in a dark room at his residence the images of persons at "the other end" of the line, extending from another part of the house, and that while the telephote—as it is called for the present—is yet in its infancy, of its ultimate perfection and utility there can be no doubt whatever. A patent has been applied for.

NAVAL ARCHITECTURE.

LAUNCHES.

ENGLISH.

Bath City.—On the 11th inst., an iron screw-steamer was launched from the building yard of Messrs. Richardson, Duck and Co., South Stockton-on-Tees, of the following dimensions, viz.:—Length over all, 268 feet 9 inches; do. B.P., 260 feet; breadth, extreme, 34 feet 6 inches; depth in hold, 22 feet 6 inches; do. moulded, 23 feet 7 inches; tonnage, O.M., 1515 tons; do. gross N.M., 1725 tons; carrying capacity, 2300 tons. She is classed 100 A1 at Lloyd's as a three-decked ship, and has been built under special survey, but is throughout considerably stronger than the requirements for classification. She has a double bottom and tank hold, capable of containing 500 tons of water ballast; two iron decks, short full poop, fitted up for the accommodation of captain and officers; bridge-house for engineers, and a topgallant forecastle for the crew and firemen. Her rig will be that of a schooner. The vessel is fitted with double derricks to each hatch, and four horizontal steam winches for the expeditious loading and discharging of cargoes. Her engines are on the compound direct-acting principle, built by Messrs. Thomas Richardson and Sons, of Hartlepool, and are of 180-horse power nominal, with cylinders of 61 inches and 33 inches diameter, the length of stroke being 33 inches, with a working pressure of 75 lb. The vessel has been built to the order of Messrs. Charles Hill and Sons, of Bristol and Cardiff, under the superintendence of Mr. W. H. Hooper, of Cardiff, and is intended for the American trade. As the vessel was leaving the ways, she was christened the *Bath City*. This is the third steamer built by the above firm for the same owners.

Benalla.—On the 13th March there was launched from the shipbuilding yard of Messrs. W. H. Potter and Son, Liverpool, a steamer of about 1600 tons, built to the order of Mr. Joseph Hoult, of that town. As the vessel left the ways she was christened the *Benalla*. The *Benalla* is the second of four steamers which Messrs. Potter have on hand for the same owner. Messrs. John Jones and Sons will fit her up with machinery and boilers, after which she will be employed in the owner's Spanish and Demerara trades.

Lily.—On the 13th March the steamer *Lily* was launched by Messrs. Laird Brothers, of Birkenhead. She is the second of the steel paddle-wheel steamers they are building to the order of the London and North-Western Railway Company for their express passenger service between Holyhead and Dublin, and is identical in every respect with the *Violet*, launched four weeks since. These steamers are built entirely of steel, manufactured at the company's own works at Crewe, under the superintendence of Mr. F. W. Webb. They have a length over all of 310 feet, with 32 feet beam, and 14 feet depth of hold, and will be fitted with oscillating engines of Messrs. Laird's construction, capable of exerting upwards of 3000 horse-power by indicator, and giving a speed of 17 knots.

Silvio.—On the 9th March there was launched from the yard of Earle's Shipbuilding and Engineering Company (Limited), Hull, a new steamer for Messrs. Thomas Wilson, Sons and Co., which was named *Silvio*. The vessel was then placed in the company's tidal docks, where she will have her engines put on board and be generally fitted out. The *Silvio* is intended for the Baltic trade, and is 240 feet long between perpendiculars, 32 feet beam and 17 feet depth of hold, and 1180 tons gross register. She is built to the rules of the Liverpool Underwriters' Registry for the highest class, and has a raised quarter deck aft, a bridge amidships and a full forecastle. She will be propelled by a single crank compound engine of 120 nominal horse-power, the cylinders being 24½-inch and 53-inch diameter, and 36-inch stroke. Steam will be supplied from one very large steam boiler, and there is in addition a powerful donkey-boiler for the winches, &c., but which may also be used to supply steam to the main engines.

Tafna.—On the 13th March a spar-decked screw-steamer was launched from the yard of Messrs. Schlesinger, Davis and Co., at Walls End. The *Tafna* is to be fitted with powerful engines by Messrs. R. and W. Hawthorn, and is built for Mr. J. Mesnier, of Paris and Swansea.

Zingri.—On the 13th March there was launched from the shipbuilding yard lately occupied by Mr. J. Stephens, shipbuilder, at Fowey, a schooner of about 140 tons burthen, A1 12 years, purchased by Messrs. Sparrow, of Plymouth. On leaving the yard she was named the *Zingri*. She is intended principally for the coasting trade.

SCOTCH.

Argo.—On the 13th inst. Messrs. Barclay, Curle and Co. launched from their yard an iron sailing ship of 1500 tons register, built to Lloyd's highest class, under special survey. She is the property of Messrs. A. and J. H. Carmichael and Co., Greenock. Her dimensions are:—240 feet in length; 38 feet in breadth; and 23 feet depth in hold. The vessel received the name of *Argo*.

Gironde et Garonne, No. 2.—On the 12th inst. Messrs. H. M'Intyre and Co. launched from their shipbuilding yard the *Gironde et Garonne*, No. 2, a handsome paddle-steamer, which has been built for passenger traffic in France. The steamer, which is of larger dimensions, but similar in most respects to the old favourite Clyde steamer, *Rothesay Castle*, will be finished in a handsome manner, and her fittings generally will be of the best description. She will have awnings all fore and aft as a means of securing additional comfort for the passengers. Messrs. Hutson and Corbett are the contractors for the engines and boilers, which are being constructed on the most approved principles. From her fine lines and the powerful machinery with which she will be fitted, it is confidently expected that a high rate of speed will be obtained.

Peter Wilkie.—On the 13th March, Messrs. Dobson and Charles launched from their shipbuilding yard a finely modelled screw-steamer, built to the order of P. and J. Wilkie, of this place. A large company assembled to witness the launch. The dimensions of the vessel are as follows:—Length, 175 feet.; breadth, 26½ feet; depth, 13½ feet; tonnage, 700. The *James Wilkie* is classed 100 A1 under special survey, and has been fitted up with all the latest improvements for shipping and discharging cargo. She will be fitted with compound surface condensing engines, of 80-horse power, by Messrs. Dunsmore and Jackson, Glasgow.

Plucky.—On the 12th inst. Messrs. Wm. Denny and Brothers lanched from their shipbuilding yard an iron screw-steamer for the Otago Towing Company, of New Zealand, of moulded dimensions, 19 feet by 18 feet by 8 feet 6 inches, and of about 95 tons gross. She will be fitted by Messrs. Denny and Co. with a pair of compound surface-condensing screw-engines, having cylinders 17 inches and 30 inches diameter, with a stroke of 24 inches. She has been built specially for the purposes of towing, and is fitted with a bow rudder, so as to enable her to turn more rapidly going astern. She will be masted and sparred for the voyage out to New Zealand, which will be made under canvas. As the little steamer left the ways she was named *Plucky*.

Ravenna.—On the 12th March, Messrs. William Denny and Brothers launched from their shipbuilding yard at Dumbarton another addition to the extensive fleet of the Peninsular and Oriental Steam Navigation Company. The principal dimensions and particulars of this vessel are as follow:—Length between perpendiculars, 380 feet; breadth moulded, 40 feet; depth moulded to upper deck, 28 feet; full poop, bridge, and topgallant forecastle, straight stem, and elliptical stern; gross tonnage about 3300. The *Ravenna* is classed 100 A1 under special survey, and is entirely built of steel, manufactured by the Steel Company of Scotland, and submitted to Lloyd's tests before being used. In many respects she is much in excess of the requirements to the highest grade at Lloyd's. She is constructed on the continuous cellular double-bottom system, 3 feet 6 inches deep, and capable of containing 485 tons of water ballast. First-class accommodation is provided for 81 passengers; on the upper deck, aft, are state rooms ranged along each side of the vessel for a length of 120 feet, the dining tables being run from end to end in the centre, allowing all the passengers to dine at once. The state-rooms are unusually large, and all the berths are 28 inches wide. The long poop deck affords an excellent promenade of 260 feet in length, the whole width of the vessel. On the main deck, the magazine, lazarette, ice-house, cooling, bullion, baggage, and mail rooms are disposed in convenient positions; and forward accommodation is provided for thirty second-class passengers, as also servants', pursers', stores and wine rooms, sail-room aad boatswain's stores, &c. The *Ravenna* is rigged as a three-masted schooner, all the masts are of iron, and the shrouds so arranged that the yards can be swung round square. The standing rigging is of charcoal wire, set up on dead-eyes. All running gear is of Manila hemp. Lightning conductors are fitted to all the masts. The machinery will be supplied by Messrs. Denny and Co., and is constructed on the compound inverted surface-condensing type, of 3500 horse-power; high pressure cylinder, 54 inches diameter; low pressure ditto, 94 inches diameter; length of stroke, 60 inches; working pressure, 75 lb. The starting gear used is Brown's patent. Steam is generated in six iron oval boilers, with eighteen furnaces; donkey boiler for supplying steam to winches, &c., and donkey engine for pumping water-ballast tanks. The *Ravenna* will be ready for sea in two months.

Rio Branca.—On March 10th Messrs. Henry Murray and Co. launched from their yard at Greenock a paddle-steamer called the *Rio Branca*, of the following dimensions:—Length, 225 feet; breadth of beam, 27 feet 9 inches; depth of hold, 9 feet. This is almost a twin boat to *Rio Apa*, which was launched by the same builders on the 12th May last, and has been constructed to the order of Mr. David Rowan, engineer, Glasgow. After the launch the *Rio Branca* was towed to Glasgow, where Mr. Rowan will supply her with a pair of compound vertical steeple surface-condensing engines, with 40-inch and 66-inch cylinders, and a piston-stroke of 5 feet 6 inches. The new steamer is to be engaged, along with the *Rio Apa*, in river traffic at the Brazils.

Willie Glen.—Messrs. Barr and Shearer recently launched from their building yard a handsomely-modelled three-masted schooner of the following dimensions:—Length of keel, 96 feet; depth of hold, 10 feet 9 inches; breadth of beam, 22 feet 3 inches; registered tonnage, 140 tons; gross burden, 260 tons. The vessel is named *Willie Glen*, of Glasgow. She is intended for the Newfoundland trade.

TRIAL TRIPS.

Beryl.—On Saturday last the iron screw-steamer *Beryl*, built by Messrs. M. Pearse and Co. at Stockton-on-Tees, had her trial trip, and was delivered over to her owner. She is a schooner-rigged iron screw-steamer, 240 feet in length over all, by 32 feet beam, and about 17 feet depth of hold, and has a full poop. Her gross tonnage is 1346 tons, and 367 ton net register tonnage, with a carrying capacity of fully 1700 tons. With a view to prevent cargo shifting, the steamer has double stanchions for shifting boards, and has the latter fitted in the holds. For water ballast there is a tank in the after part of the vessel. For the speedy discharge and loading of cargo the ship has every facility in the shape of four steam winches and all necessary appliances. Messrs. Blair and Co. (Limited), Stockton, are the builders of the steamer's engines, which are on the compound surface-condensing principle of 110 horse-power nominal, having a reply telegraphic communication between the engine-room and the bridge. The *Beryl* is the second vessel built by Messrs. M. Pearse and Co. for the same firm of owners at Hull, being intended for the Mediterranean and Baltic trades. Being slipped from her moorings at the yard early in the morning, she proceeded under easy steam into the Tees Bay. Shortly after seven o'clock her head was turned towards the Tyne from off Hartlepool Heugh, and in a steady run, the engines making eighty revolutions per minute, she travelled the distance to Tynemouth Castle (over 21 miles) in about an hour and fifty-five minutes, the log registering eleven knots per hour. The compasses being adjusted off the Tyne, the steamer afterwards entered the Tyne Docks to load cargo for Genoa.

Glenwilliam.—On the 6th March, the new steamer, *Glenwilliam*, 500 tons, built by Messrs. H. M'Intyre and Co., Paisley, and engined by Messrs. Hutson and Corbett, Glasgow, went down the Clyde to adjust compasses and run her trial trip, which was made in the Gareloch. The day was very boisterous, but, notwithstanding, she made twelve knots, her engines working smoothly. The trial proving satisfactory, the vessel returned to the harbour in the evening, where she is taking in a cargo of coals. She is intended for the iron ore carrying trade between Bilbao, Barrow, and other ports.

Grappler.—On Monday last week the steamship *Grappler*, the new steamer built to the order of the West India and Panama Telegraph Company (Limited), went round to London and took her trial at the Maplin Sands. The *Grappler* was built by Messrs James Laing, of Sunderland, and engined by Messrs. R. and W. Hawthorne, of Newcastle. She measures 868 tons, and her machinery is capable of indicating 550 horse-power. The steamer is arranged with a raised quarter-deck aft, and a bridge deck amidships; the crew are accommodated forward, the captain and officers amidships, and the engineers and firemen aft. The propelling machinery is placed well aft, and the cable tanks (three in number) are so arranged as to give ample space on both the upper and lower decks for the cable work proper. The steamer has been constructed from the designs and specifications of Wm. R. McKaig and J. Carlton Stilt, of Liverpool, consulting engineers for the company. The trial was considered in every way successful, and the steamer went up to Silvertown to receive her cables and cable machinery.

DISASTERS AT SEA.—There were thirty-three British and foreign wrecks reported during the week ending Saturday last, making the total for the present year 320, or a decrease of 110 as compared with the corresponding period of last year. The approximate value of property lost was £610,000, including British £520,000.

BOILER EXPLOSION ON BOARD A STEAMER.—The boiler of the steamer *Colomba*, belonging to the Valery Company, bound for Algiers, burst in the harbour of Bona on Saturday. The steamer was driven with great force towards the shore and crashed into two Spanish feluccas, injuring very seriously twenty-five men who were on board of them. Two firemen belonging to the *Colomba* were were killed by the explosion, and the chief engineer was so severely injured that his life is despaired of.

SHIPBUILDING AT WHITEHAVEN.—On Tuesday a meeting was held at Whitehaven for the purpose of establishing a new company to carry on shipbuilding. Mr. Holder, who presided, announced that £65,360 had been subscribed in shares capital, and arrangements were made for registering and starting the company at once. It was stated that a Liverpool firm were going to give the company an order at once, and the keel would be laid down shortly.

ROYAL NATIONAL LIFEBOAT INSTITUTION.—At the annual meeting on Tuesday of this institution, the report read by the secretary stated that during the past year 637 persons had been rescued from wrecked or endangered vessels by the lifeboats of the institution, without loss of life to any of the brave men who formed the crews of the boats; whilst the number of lives saved during the fifty-six years from the establishment of the institution, either by its lifeboats or by special exertions, for which it has granted rewards, is 26,906. The income of 1879 amounted to £30,125, and the expenditure to £36,546. On the motion of Lord Galloway, seconded by Capt. the Hon. Francis Maure, R.A., the report was adopted.

NOVEL STEAM YACHT.—There is just now, says the *Iron Age*, a furore for steam yachts. The very latest is an iron steam catamaran, an idea stolen from the South Sea Islanders, to be built by parties in Nyack for Commodore Wm. Voorhies, of yacht club fame. Such craft as the *Grace* and *Tidal Wave* are not up to the times, and the demand is now for a double hull with double engines, all of iron, expected to make a speed of 25 or 30 miles an hour. Her length will be 105 feet. Mr. Roach, on the Delaware, has orders for a splendid iron yacht from Wm. Belden, of New York, and the Cramps are building for New York parties another of the same general description. It is also reported that David Kirby is about to build a steam catamaran at Rye, and a steam yacht is spoken of as contemplated by C. J. Osborn, N. Y. Y. C., but the paper fleet is much larger this winter than the fleet actually built.

A BALTIC AND NORTH SEA CANAL.—The idea of connecting the Baltic with the North Sea by a canal navigable for large sea-going ships and steamers has of late been much discussed in Germany, and in a pamphlet just published under the name of "The Baltic and North Sea Canal," the writer maintains that if such a canal were constructed by a private company, even for commercial purposes only, it would be a paying concern. A canal from St. Margereten Brunsbuttel, in the estuary of the Elbe, to Kiel or Eckernford in the Baltic, would save vessels sailing to the latter sea from the North Sea, a troublesome detour of 204 nautical miles through the intricate waters of the Cattegat and Sound; while it would shorten the voyage of vessels sailing from the estuary of the Elbe or Weser by 387 miles. Consequently, steamers using the proposed canal would save from 21 to 48 hours, and sailing vessels probably at least a week. From official returns it appears that in 1878 27,500 sailing vessels, and 9170 steamers passed through the Sound, and for the reasons mentioned above the great majority of these vessels would, it may be assumed, use the canal if it were constructed.

THE ADAPTATION OF OCEAN STEAMERS TO WAR PURPOSES.—On Thursday afternoon, under the presidency of the Marquis of Lansdowne, at the United Service Institution, naval and military officers discussed at length the paper which Mr. Donald Currie has read on the subject of adapting ocean merchant steamers that they might be readily converted into an aid to the navy. In reply to Admiral Sir Spencer Robinson, Mr. Currie explained that he had no idea of having the ships carry war material in general, but that they should be so fitted as to be able to take on board guns and war stores. The men, too, employed on the steamers might be trained as in the Royal Naval Reserve. In the course of the discussion it was suggested that the vessels might readily be adapted for defensive purposes in case of a sudden war, and that stations were necessary where the stores could be supplied; and, moreover, that the torpedo service would be a good supplement. The general opinion seemed to be that an excellent supplement to the Royal Navy could be worked out of some of Mr. Currie's suggestions. Mr. Currie was warmly thanked for his paper.

THE GRAIN CARGOES BILL.—At the annual meeting of the Liverpool Shipowners' Association on Monday, the committee's report referred to the steps they had taken as to Mr. Plimsoll's Grain Cargoes Bill. The Chairman, Mr. Poole, said that the Grain Cargoes Bill, as proposed by Mr. Plimsoll, afforded another striking illustration of the good intentions of that man, and exhibiting at the same time his usual recklessness and utter ignorance when dealing with questions of shipping. From the remarks which Lord Sandon made when he persuaded the House of Commons to refer the question at issue to a select committee they would see that the memorial transmitted by the association received from his lordship the greatest possible consideration. The interest which they represented had been pointed at very freely of late as one which was fast waning before the rising glories of steam. But they might rest assured that as long as energy and intelligence remained to them so long would the means be found to adapt the sailing ship to those altered conditions with which she might be required to contend, and enable her to compete successfully with her powerful rival for at least some portion of the carrying trade of the world. The report was unanimously adopted.

YACHT-BUILDING ON THE CLYDE.—The coming summer does not promise many yachting novelties. Yacht-building has not been so slack for many years. Fife has something on hand, but other builders are idle. The class of cruisers are being supplanted by steam yachts. The lower reaches of the Clyde promise little in the way of new craft, but there is building at Partick a cutter yacht about which very great interest must be felt. This cutter is building in the yard of Messrs. Henderson, Partick, under cover and under conditions which will insure her buing classed as the most substantial yacht yet built. The cutter is built entirely of Newton steel. Her frames, flooring and keelsons are of steel, with steel ties, braces and plates in all the possible positions where these may be of service. Her plating is entirely of steel, and presents an outside surface as smooth as glass. While her construction has given opportunity for unexampled strength, her build will invite some comment. She varies considerably from all the large cutters yet built, but above water will present an extremely handsome broadside. Mr. G. S. Watson, of Glasgow, is the designer of the vessel, and his wonderful success of last year with the 10-ton cutter, *Madge*, will be reckoned guarantee for the excellence of this new cutter's design. Apart from her likely speed as a racer, she is bound to be a comfortable cruiser. The cutter is being built by Messrs. Henderson to the order of Mr. John Clark, of Paisley, from designs by Mr. G. L. Watson, and is being built under the supervision of Mr. Watson and Captain Mackie, who is to sail the cutter. In building this cutter Messrs. Henderson have completed the steelwork in the most perfect fashion. The workmanship throughout is most beautiful; the "iron work" for the spars and fittings could not be excelled for neatness and good taste. Spars have been tried and picked by the builders till a perfect Oregon mast was got without a knot in it. The spars do not look heavy for a vessel carrying 50 tons of lead ballast, half of which has been run into her. The bowsprit will be carried amidships through a cranse in the stem head. The fittings of the yacht will be handsome but not overdone. The cabins, which will be unusually lofty, will be fitted up from novel designs. The cutter's dimensions will be 80 feet 6 inches by 16 feet 1 inch. *Kreimhilda* is 79 feet 6 inches by 17 feet 6 inches; *Formosa*, 82 feet by 17 feet; *Vol-au-Vent*, 79 feet 3 inches by 17 feet 5 inches; *Arrow*, 79 feet 2 inches by 18 feet 9 inches. Mr. Clark's cutter measuring 89 tons will be longer than either *Kreimhilda*, *Vol-au-Vent* or *Arrow*, which yachts are over 100 tons in measurement. *Formosa* is 104 tons, but Mr. Clark's cutter will have the length of this cutter overall. The only competitor in proportions she has is a new 90-ton cutter building by Inman, at Lymington, for Mr. William Jameson, of Dublin, owner of the *Enrequita*, and designed by Mr. Richardson, of Liverpool, who designed the *Lily*, *Loro*, &c. The dimensions of this cutter will be 81 feet by 16 feet 2 inches. She is to be an exceedingly powerful boat, and, to keep her on her feet, is to have 32 tons of lead on her keel. From her extreme length for beam she will require an unusual ballasting, but the vessel is in good hands to come out a dangerous competitor for any cutter afloat. With old *Arrow* flogging the fleet last season, it looked as if a new "departure" was wanted, and the cutters designed by Watson and Richardson promise to be novelties. Between the Clyde and the Solent there has long been a keen rivalry, but the coming summer will narrow the contest to a fine point. In the meantime it looks as if the Cowes cutters were out of it, but the coming season will show, unless, like Ratsey's fleet of sixties, they haul down their racing flags as they did to Neva.—*Glasgow Herald.*

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TO READERS AND CORRESPONDENTS.

"THE HISTORY OF STEEL."—In a letter from Mr. R. F. Mushet upon this subject, which appeared in our last issue, towards the close of the second paragraph the word "iron" should obviously have been printed "manganese." In order, however, to make the passage quite clear we reproduce it correctly. "If a cup of tea contains one lump of sugar it is still tea, and tea it will remain, even if a second, third, or fourth lump of sugar be added. So, in like manner, if spiegel contains 10 per cent. of manganese it is still spiegel, and the fact of its containing sometimes 20, 30, 40, or even 80 per cent. of manganese does not make it other than spiegeleisen, namely, an alloy of iron and manganese containing carbon. To make the world, however, believe that my process was superseded by ferro-manganese, this new-fangled title was conferred upon spiegel rich in manganese."

CORRESPONDENCE.

THE SPEED OF SHIPS.

To the Editor of IRON.

SIR,—I desire to draw the attention of shipbuilders to the following method of increasing the speed of passenger steamships:—Provide the ships with a number of water-tight compartments, which may be filled with water by opening valves on the ship's bottom, and emptied by the circulating pump. Either of these operations may be performed in a very short space of time. In fine weather the compartments may be entirely or partially emptied, according to the weight of cargo in the hold, in order that the draught may be as light as possible, consistently with safety, reducing the resistance and friction of the water to a minimum, and securing the highest practicable speed. In the event of rough weather the draught may be increased by admitting water to the compartments, and the amount will be regulated by experience in any given ship. By such an arrangement the vessel's draught may be adjusted for every kind of weather. As vessels are at present constructed, when a ship goes to sea, her draught is regulated with a view to any weather that may occur, and she is consequently deeper in the water than is necessary for stability in fine weather, and therefore cannot attain the speed which might be reached were there less resistance to overcome.—I am, &c.,

FREDERIC R. HONEY.

Sheffield Scientific School, Yale College, U.S.A.,
March, 1st, 1880.

RAILWAY COLLISIONS.

To the Editor of IRON.

SIR,—Will you allow me to make a few remarks on the recent deplorable disaster at Burscough Junction on the Lancashire and Yorkshire Railway? In the reports it is stated that "through some blundering on the part of the signalman the accident took place." Most probably. Similar accidents have not unfrequently occurred before from the same cause, and will occur as frequently again so long as the cause exists. But how long is this to continue? How long is safety of life and limb to remain dependent on the infallibility at all times of a signalman? I therefore, as a railway engineer of some experience, beg to call your special attention to the fact that had an absolute block system been in use, the collision never could have happened.

Take the case of the London and South-Western for instance: if they had an absolute block system on their line, the accident by which the shareholders have been so terribly mulcted in compensation never could have occurred. As it is, they are entirely at the mercy of a signalman, who can let any number of trains follow each other into the same section, as the man ahead of him has no mechanical control over him whatever.

By the introduction of the block system, it was supposed collisions were to be rendered impossible. The inference was correct, but the mistake made was in supposing the system introduced was really and practically a "block system," which in my opinion it is not. Such a system, to be effectual, must be one which puts it perfectly out of the power of a signalman to make a mistake with his levers, points or signals, and also which makes it impossible for two trains following each other to be in the same section together, or to turn the train on to the wrong line.

The present so-termed absolute block system merely puts a moral check upon the signalman, as there is only mechanical communication between himself and the distant signal of his own station. Amongst railway men it is well known, that no block system is throughly effective unless it places three stations in communication with each other by mechanical means only, no matter what the distance may be, so that each signalman absolutely cannot act without the consent of his *confrères*, both in front and behind him. If I recollect rightly, Colonel Yolland—who from his position and experience is entitled to be heard with the greatest respect—in his report on a collision which occurred on the Metropolitan District Railway, and which views he again repeats in the strongest terms in his report on the collision which took place at Acton on the North London Railway, explained at length, that a system could only be effective by a combination of electric and block interlocking, by which mistakes of signalmen are absolutely prevented, and he further pointedly referred to the system now in operation on the London, Chatham and Dover Railway. If the system this Company use is so good, why do not the other lines take it up, and throw the imperfect one aside, and not only save the shareholders' pockets, but, what is far more important, human life?—I am, &c.,

RAILWAY ENGINEER.

THE PALLISER GUN.

To the Editor of IRON.

SIR,—I have read the reprint of Sir William Palliser's letter to the Secretary of State for War published in your valuable journal dated the 20th ult. With your permission I will make a few remarks on the subject thereof. I am glad to see how true my theory on the bursting of the 38-ton gun is, for Sir William states "that the C coil or main jacket of the breech was cracked right through." This exactly bears out what I said in my last letter about the contending force that was set up in the gun between the two charges of powder. The reason why I lay so much stress on this is, that there are people who are unable to find out how the second charge was ignited. I think any one who takes the trouble to read my last letter will see and understand the whole action that was set up in the gun, and which (as I have just remarked) has been fully borne out by the breech jacket having been cracked. In dealing with the rest of Sir William Palliser's letter, the first point is to remember that it is not written by a mere outsider, but by an interested inventor. To read Sir William's letter, one would think that heavy ordnance made on his principle would last for ever. This high opinion of their inventions is the great drawback of inventors. As regards the question whether the Fraser or the Palliser system is the better for making heavy ordnance, the whole question lies in a nutshell. When made on the Fraser system the manufacture of heavy ordnance has the following advantages and disadvantages. The advantages are great rigidness, and a hard unyielding path in the gun for the projectile. The disadvantages are, that there is, or may be, great difficulty in tempering the steel tube, and that it is nearly impossible to get the wrought-iron coils to contract in an equal manner on the steel tube. The result of this tendency of the wrought-iron coils to contract unequally is, that a portion of the steel tube may be only half supported; the result is, that when the gun is fired the enormous pressure of the powder gases cracks or breaks the steel tube at the unsupported place. This last disadvantage is a rather grave one, for those who are acquainted with the subject are well aware how very difficult it is to get large masses of metal to cool in an equal manner; so much so, that the least current of cold air may have a very injurious effect. Such, in a few words, are the merits and demerits of the Fraser system of making heavy ordnance. As to the question of guns made on this principle being liable to burst without warning and with a great violence, I somewhat doubt it; and for the reason that, for the causes I have just named, the steel tube will crack or break and thus give warning of an approaching catastrophe.

Sir William bases the chief merit of his system on the fact that guns made on his plan are lined with a soft and ductile metal, instead of the hard unyielding metal used in the Fraser system. The result of using this ductile metal is, that if the projectiles jam when the gun is fired, the walls of the gun yield to the abnormal pressure of the powder-gases, and allow them to pass between them and the projectile. By this means Sir William claims complete immunity for his gun from sudden or violent rupture, and this is the sole advantage of his system; there may, perhaps, be one other, namely, that the manufacture is a little cheaper than that of the Fraser gun. Such are the advantages. Now for the disadvantages. Firstly, when the walls of the gun have yielded in the manner just mentioned they take a set in that one place, and, as a result, we get a second disadvantage, namely, that when the gun is again fired the projectiles may be more or less erratic in their flight. Such are the disadvantages of Sir William's system of making heavy ordnance, but he may say that guns made on his system would only take the set under very abnormal circumstances. But because Sir William says this, is it the less likely to occur? We must remember all the circumstances of the case, which are these: that we have got a certain soft ductile material, which will take a certain set or form if subjected to a certain sudden force,—what proof have we that the same set or change of form may not be occasioned by repeated minor forces of a like nature? This is perhaps the chief question which has to be decided in the Palliser system. I do not mean to say positively that this kind of deformity would take place in guns made on Sir William's system, but I think I have shown pretty clearly that they might.

I also see by Sir William Palliser's letter that he dwells on the fact that the walls of guns made on his principle are much thinner than those made on the Fraser. I think that no one who has read my foregoing remarks on the subject will be surprised at this, for of course the thinner a ductile substance is the more readily it will yield to a given force. But Sir William brings forward this argument for two reasons, first, to show that the guns made on his principle, though thinner in the walls, are stronger than those made on the Fraser system, and secondly, to show (as a result) how much lighter his guns would be. But the fact is that both those advantages are not an unmixed good, for the walls of the gun being so very thin, would make them more liable to take the set.

In conclusion, I will just allude to Sir William's offer to have the late 38-ton gun repaired on his own principle and at his own cost. Now, suppose Sir William is allowed to do so, what guarantee have those interested that, did the gun burst, Sir William Palliser would not say it was hardly a fair trial, for the gun was more or less shaken by the great punishment it had already received? I do not say but what Sir William's observations would be merely just, but then what would be the end gained? Did the gun not burst, then Sir William would have a great victory to declare; so that, in either case, Sir William Palliser would not lose much beyond the money spent in the rebuilding of the gun, and he might be a great gainer.—I am, &c.,

M. E. P.

1st March 1880.

P.S.—I have just read your note at the end of my last letter. I was quite aware of crusher-gauges being used as you describe, but I was not aware that any plan had been tried for taking the velocity of a projectile within the bore of a gun. Will you kindly inform me where I could see an account of the apparatus used?

[We believe the particulars are to be found in some of the early reports of the Ordnance Select Committee.—ED.]

LUBRICANTS.

To the Editor of IRON.

SIR,—I have from time to time, been startled by statements from people, otherwise well informed, that certain lubricating oils, submitted to me for analyses, gave off when used "spontaneously igniting gas." Of course it only needs the most elementary reasoning to prove that as the oils are compounds only of hydrogen and carbon no such combustion is even possible. If it were so, an ordinary spirit lamp would light itself (which we all know it does not) on the removal of the cap: and we could never tap a barrel of benzoline without an explosion. The idea has, doubtless, been fostered by the use of oils which have a low point of ignition. These oils are most dangerous, from the fact that this inflammable vapour is given off copiously at a temperature often attained by a neglected or ill-lubricated high-speed bearing. There can be little doubt that to the extensive use of these oils many destructive mill fires are due. "Spindle oils," as the numerous ingenious mixtures are now euphoniously termed, are curiously variable and uncertain compounds. They can be, and they are, made and sold of all qualities, and at nearly all prices. With the exercise of due care in the selection and purchase, mineral oil is probably one of the best and cheapest spindle oils in use. The specific gravity of spindle oil, as sold, is no indication of its quality, as is popularly supposed, and this supposition has led many astray. I find one merchant recommending that no spindle oil should be used under a specific gravity of 0·915—that this very oil, offered by him, while complying with this requirement, consists of a mixture of resin and mineral oils in nearly equal proportions, while it flashes at a temperature below that of boiling water!

A very little consideration suggests that the sp. gr. or body of the oil should be calculated for the work to which it is to be applied, or the weights and speeds of the moving parts of the machinery. Oils for lubricating purposes should be carefully selected with a view to the special use for which they are intended, and the weights and speeds are necessary elements in the problem. They should—in all cases—possess the properties following—

(1) They must be free from fatty acids, mucilage and gelatine.

(2) They should, generally, possess a specific gravity of about 0·910 at 15° C.

(3) They should not give off inflammable vapour under a temperature of 120° C.

Again, a further consideration than that of safety from fire presents itself in the selection of lubricators, viz., that of damage to machinery. As an illustration of this, I may state, that the use of an oil which was found to contain 5·5° per cent. of free acid for six months in the cylinder of a steam engine, produced a dark, curdy, viscid matter, which, on analysis yielded nearly 6 per cent. of metallic iron; the measure of destructive friction between piston and cylinders in that period. Another consideration is the absolute loss of power resulting from the use of an ill-selected oil, and necessarily following on the destructive wash just mentioned.

It may be generally stated, that the use of poor low-class lubricants, or of oils ill adapted to their work, necessitates an increased consumption of fuel. I have found, as a fact, in a large works that the use of a poor oil as compared with a good oil, necessitated an increased consumption of coal for 1000 h.-p. indicated, of two and a half tons per day of ten hours. It is specially worthy of note here, that the best article is the cheapest, and is most likely to be obtained from firms of acknowledged standing and respectability. The values of lubricating media are constant, and are readily ascertained. The detection of worthless or dangerous mixtures is equally within reach. The use of a good lubricator absolutely removes one of the items of risk of fire, and consequent destruction of property:—it gives less trouble and so saves time and money; it reduces wear and tear and consequent stoppages and cost of repairs, and it necessitates less motor power. The selection and use of the best oils, for specific purposes, for the above and other reasons, must recommend itself to mill-owners and others. In no less a degree should it obtrude itself upon insurance companies who seem strangely to neglect this factor in their calculation of risk.—I am, &c., JOHN COLLINS, F.C.S., F.G.S.

Bradford Buildings, Bolton, 8th March.

NOTICES OF BOOKS.

The Shareholders' and Directors' Companion. By F. B. PALMER, barrister-at-law. Second edition. London: Stevens and Sons.

WE have here an enlarged and improved edition of a small but comprehensive manual of everyday law and practice relative to commercial companies, and as nearly everybody nowadays has some relations to these, a book which shows the duties and responsibilities of governors and shareholders addresses itself to a very large constituency indeed; while as the laws regulating joint-stock undertakings, are similar in the colonies to those in England, the field of the book is thereby still farther extended. The information supplied by the author is arranged under some sixty heads, and appears to include everything connected with companies, from their formation to their winding-up, and reference to any of these particulars is further assisted by a copious index.

A Treatise on Statics, containing the Fundamental Principles of Electrostatics and Elasticity. By GEORGE M. MINCHIN, M.A. Dub. Second edition. Oxford: Clarendon Press. 1880. Pp. 518.

IN this, the second edition of Professor Minchin's important and valuable work, the proof of the parellelogram of forces has been based entirely on the Newtonian definition of force, and has therefore been made to follow from the composition of velocities. And "in view of the enormous development of Mathematical Physics, and the wonderful inventions depending on the small strains and vibrations of natural solids which have been made within the last few years, the study of the equilibrium and motion of bodies as they are, and not as they exist in abstraction," is facilitated by the introduction of a chapter on strains and stresses. Students who intend to go through the present work must be provided with a fairly full mathematical outfit: the engineering student thus equipped will read it with pleasure.

The volume forms one of the issues of the Clarendon Press series.

The Gas and Water Engineer's Book of Reference. By GEORGE BOWER, St. Neot's, Huntingdonshire. 1880.

ALTHOUGH a business compilation, and in that way calculated to be of service to the author and his clients, this volume contains a good deal of matter of general interest. It opens with a concise account of the origin and development of gas lighting, followed by a description of the theory and practice of the gas manufacture, the *modus operandi* of the various apparatus being explained in connection with their details, which are amply illustrated by engravings. Much information, interesting and important to all connected with the gas manufacture, is supplied on the residual products left after the process. The properties of coal gas, its consumption and distribution, are fully and intelligently discussed, price lists are given, and at the end various useful memoranda, tables, &c., connected with the manufacture. In a short notice of electric lighting, the author, in common with other eminent gas experts, expresses his belief that while the mechanical production of light will ultimately establish itself as one of the systems of artificial lighting, it will by no means supplant gas, but rather stimulate its farther development in other directions.

Plumbing: A Textbook to the Practice of the Art and Craft of the Plumber. With supplementary chapters upon House Drainage. By WILLIAM PATON BUCHAN. Second Edition, with 300 illustrations. Crosby Lockwood and Co. 1880. Pp. 268.

THE illness which befel the Prince of Wales at Londesborough House was not a bad illustration of the truth of the French proverb—"à quelque chose malheur est bon." The spectacle of a prince royal, certainly no weakling in constitution, smitten down in the midst of a princely dwelling by such a dirty nihilist as sewer-gas, filled respectable bosoms with alarm. Not a few staid householders made for themselves the discovery which, in Swift's verse, fills with horror the lover of Celia, and the nihilist aforesaid has now a distinct and recognised place in the ranks of our enemies. All eyes were turned upon the sanitary engineer as the one who should save society from itself; and sanitary engineering bids fair to become a fairly well-organised branch of common sense. But the engineer is, as it were, the general who lays the plan of operations; the rank and file of the sanitary army are the grimy persons mysterious with strange tools and ever-present coils of bright metal, whose doings no common mortal loves to question. For them the author has drawn up the present work, almost, he tells us, the first of its kind, which is a sort of manual of their drill. The remote cause of its writing was the accident above-mentioned which sent a thrill of alarm through the whole entire British nation.

Vows to be sweet and clean, however fervently made, are not much more easy to perform than vows made never to speak ill of one's neighbour, never to cheat in business, never to—in short, never to be human. We do not know how to be sweet and clean, or if we do, other people will not let us be so. Some there are, as the author complains who will cover their walls with useless pictures, bought at fabulous cost, while they grudge outlay on spigot and faucet drain-pipes, and such-like artillery, with which to carry on the good fight against the subtle and unrelenting foe lurking beneath the mansion. But many more are really anxious to do at least what they can, and for these there are chapters in the present work which will be read with profit. Written primarily for the instruction of apprentices, and going conscientiously through every branch of the craft of plumbing, the author finds that the chief sales of his work have taken place among the general public. While we congratulate the public on its excellent good sense we can yet wish that the plumbers—a specially unteachable guild of British workmen, so far as we have seen—would take advantage of the sound and practical advice given concerning their trade by Mr. Buchan. Roofs, windows, rain-water drainage, w. c.'s, baths, cisterns, and house-drainage generally, are all treated of one after the other in the plain language of a man who has learnt how to handle his tools like a workman and his pen like his tools. His volume, which may well take the place of the "Buchan's Domestic Medicine" of the days before sewer gas, will, we hope, bring nearer the day when it will no longer be necessary to "shut your mouth and save your life" with Mr. Calvert, or drink perpetual boiled water with Sir Henry Thompson and Professor Frankland.

We may add that the work is strictly confined to its special subject, "plumbing," and does not discuss gas-fitting.

Woodworking Machinery. By M. POWIS BALE, C.E., M.Inst.C.E. Crosby Lockwood and Co. 1880. Pp. 362.

CONVERTERS of timber, wholesale joiners, the members generally of the building trades, architects, and owners of and dealers in timber, owe Mr. Bale tribute to the value of the cost of his book. It is sound from end to end, well designed and well executed. Starting with the rise of woodworking machinery, the era of which opened in 1791 with Sir Samuel Bentham's remarkable patents, the author sketches in brief its past history, and shows it in its present fulness. Machines of a special class by various makers are grouped together according to their class, and are compared together, the history of the invention going hand in hand with its description, and both being supplemented by a comparison of the "points" of the several competing machines. These, while by preference English are described, as being more immediately within the reach and choice of readers, include the best types current on the Continents of Europe and America. Circular saw benches are first treated of, then timber and deal frames, then planing and moulding machines, band and fret saw machines and the remaining classes of wood-working machinery, in which the field becomes smaller and the examples fewer. The work is completed with chapters of a more general nature, such as motive power as adapted to the classes of machinery described, the arrangement of saw-mills, framings, bearings, foundations, shafting and gearing, circular and straight saws, band-saws, cutters, &c., with an appendix of rules and tables. Between forty and fifty full-length portraits of various machines are given, English and foreign.

Apart from the technical value of the work as a guide, at once intelligent and impartial, to the leading characteristics of the principal types of wood-working machinery, it is refreshing to find in the author an illustration of the thoroughness which he so well appreciates in the old masters of the mechanical arts. Research has been made into the beginning of each new type of machine, and not a few unhistorical prepossessions will have been overthrown:—Thus: "The band saw machine, although very generally believed to be of French origin, was really the invention of an Englishman. In the year 1808, a patent was taken out in this country by one William Newberry, for a machine for sawing wood, in which an endless band or ribbon saw, strung over two wheels, was used." The band-saw was brought before the public notice again in 1855 by M. Perin of Paris, and was thereupon patented in this country by a M. Parienté. It was again patented here by Exall and Barbour, so that, as the author quaintly says, "on the whole, it must be held to have been well patented." A superior method of tempering the blades was, however, first carried out in France—vulgarised we cannot say, since the process is still kept secret. With reference to outside competition in machine design, the author makes the following remark:—"It is our opinion that much of the present success of American competition is due to the attention paid to the smallest details in their machine construction, which either increases the range of work performed, improves the quality, or lessens the cost of production, which saving in a day may be infinitesimal, but when multiplied by months or years amounts to a gigantic total. In comparing English and American machines for performing the same class of work, many American machines are carried *further* than our own." That is, the American designer is not so ready as the English one to say, That 'll do! It is curious to notice, in this connection, the high finish given by Fay, of Cincinnati, and Arbey, of Paris, to their drawings, compared with those of English machines printed beside them.

PAMPHLETS.—*The Gault.* By F. G. HILTON PRICE, F.G.S. (London: Taylor and Francis.) The Gault is a formation of clay and mud, low down in the cretaceous system, and was deposited in a sea extending from the south of Germany to the English Midland counties, and occupying the bed of the North Sea. The deposit is economically important as furnishing in Cambridgeshire and elsewhere phosphatic nodules valuable as a manure. The present monograph is the substance of a lecture originally delivered in the Woodwardian Museum, Cambridge, in 1878. Prefixed is a copious bibliography of the subject, and the author then, after sketching the area in which the Gault is found in England and France, proceeds to describe the various beds of the typical section of the formation at Folkestone, to trace it along its outcrop in the various counties from Kent to Yorkshire, and to outline its different areas on the Continent, correlating the palæontology of these with that of Folkestone. In an appendix he gives an account of various well sections and borings in the English Gault, and in tabular form a comparative view of characteristic fossils over the greater part of its extent.—*Letters from Europe.* By the Hon. W. D. KELLEY. (Philadelphia: Porter and Coates.) This is a reprint of six letters on European affairs, written by Judge Kelley to the *Philadelphia Times* during the summer of 1879. They are the production of a man as intelligent and less prejudiced on foreign matters than is usual with Americans. The subjects discussed include the German currency controversy, the American naturalisation question and the German Government, and the condition of England. The writer visited this country in the depth of the late commercial depression, but he takes anything but a pessimist view of our position. "What," he asks, "shall be inferred from this combination of disastrous conditions, and the infinite number of facts with which they might be supplemented and confirmed? May they justify us in speaking of 'effete monarchy and aristocracy,' and prophesying the bankruptcy of England?" In reply he says, "I think not. My impression is that the throne of England was never more firmly seated in the affection of the people, and that, apart from other favouring considerations, the influences which are sometimes supposed to control legislatures in the election of United States senators have done much to confirm the faith of the people in an hereditary peerage. Nor is the bankruptcy of the British Islands impending. England is the world's creditor. Every nation is in debt to her, and there is no field for the investment of her accumulated capital. Her losses will be immense but not ruinous, as are those which debtor nations are suffering from the same cause. As creditor she loses by the failure of individuals, corporations, and states, the world over; but while ruin overtakes them, what happens to her is but the reduction of surplus capital, so slight, relatively, as to leave her the means with which to buy in, at her own price, the assets of her debtors, and to hold them until the repeal (pursuant to universal treaty stipulations) of unwholesome laws shall restore the value they possessed before the value of the world's metallic money was arbitrarily reduced." The judge adds that "the spirit of compromise that controls the government in all great crises will preserve the empire, and London will continue to be the monetary centre and the creditor of the world."—*Remarks on the Assessment of Reliable Value of Hereditaments containing Machinery.* By JOSEPH POTTS, jun. (London: E. and F. N. Spon.) The subject of this pamphlet is treated with especial reference to the case of Laing *v.* the Overseers of Bishopwearmouth, in which the Court of Queen's Bench decided that all machinery, although neither fixed nor attached to the freehold, is liable to be rated, inasmuch as it adds to the value of the premises. This, in Mr. Laing's case, was a shipbuilding yard, and the judgment necessarily caused general alarm throughout the trade. Mr. Potts contends that the judgment in question does not bear the interpretation put upon it, and that if it did it is valueless, as founded upon assumption and not upon facts. The Halstead case, a similar one, in which a quite opposite decision was given, is held by the author to have been settled in accordance with law. He then states, in considerable detail, his own views on what is assessable and how it is to be assessed, and concludes with advising that any attempt similar to that in Laing's case should be promptly and strenuously resisted. We cannot spare the necessary space for even an abstract of the author's recommendations, but parties interested in the question would do well to procure the pamphlet for themselves.

BOOKS RECEIVED.

Engineering Geology. By W. H. Penning, F.G.S. Illustrations and Coloured Plates. London: Baillière, Tindall and Cox.

Parliament and the Constitution. By J. Pullan. London: W. Stewart and Co.

Laxton's Builder's Price Book for 1880. London: Kelly and Co.

Remarks on the Rating of Gas and Water Works. By J. Quick, jun., M.I.C.E. London: E. and F. N. Spon.

Spon's Dictionary of Engineering, No. 10. London: E. and F. N. Spon.

The Principles of Graphic Statics. By G. S. Clarke. London: E. and F. N. Spon.

NEW BOOKS.

Criticism (A) of Dr. Croll's Molecular Theory of Glacier Motion. By J. J. Teall. 8vo. Simpkin and Co.

Engineering Geology. By W. H. Penning. Crown 8vo. Baillière.

Geodesy. By Col. A. R. Clarke. 8vo. Macmillan and Co.

Handbook to the Public Picture Galleries of Europe. By Kate Thompson. Third Edition. Macmillan and Co.

How to Make Money by Patents. By C. Barlow. Sixth Edition. 8vo. Marlburgh and Co.

McCulloch's Dictionary of Commerce and Commercial Navigation. New Edition. 8vo. Longmans and Co.

Notes on Physiology. By H. Ashby. Second Edition. Longmans and Co.

Science Primers:—Introductory. By Prof. Huxley. 8vo. Macmillan and Co.

Proceedings of the Royal Geographical Society. New Series. Vol. I. Royal 8vo. Stanford

OBITUARY.

MR. JOHN MARTIN, banker, head of the firm of Martin and Co., Lombard Street, died on Sunday week at his seat, the Upper Hall, Ledbury, at the age of 75. The deceased gentleman, who was the eldest son of the late Mr. John Martin, M.P., of Overbury, Worcester, and of the Upper Hall, Ledbury, was born in 1805, and represented Tewkesbury in the Liberal interest in the House of Commons from 1832 till 1835, and again for the long and uninterrupted period of twenty-two years, from 1837 till 1859.

FACTORY NOTES.

Leaving Work without Due Notice.—On Friday, 5th inst., sixty miners in the employ of the West Yorkshire Iron and Coal Company absented themselves, from work without notice, owing to a dispute arising out of fourteen miners mixing stone with their coal. A claim of £2 from each of the defendants was subsequently made and allowed by the bench, with costs.

William Jessop and Sons (Limited).—The directors of this company, who have the largest steel works in Sheffield, have just issued their fourth annual report. After paying interest on mortgage, loans, &c., there remains a net balance of £17,980. Out of this a dividend at the rate of 5 per cent. is declared, which will absorb £11,530 10s. Sums are set apart for depreciation, &c., and £1830 goes to the next account.

Liquidation.—A petition for liquidation of his affairs by arrangement has been filed in the Warrington County Court by Messrs. Robert Davies and Co., solicitors, on behalf of Mr. William Bate, of Runcorn and Winsford, boatbuilder, coal and salt merchant and salt proprietor. The liabilities are stated at £20,500. The court has appointed Mr. G. S. Holmes (Holmes and Johnson, accountants, Wigan) as receiver and manager of the business.

Charles Cammell and Co. (Limited).—The directors of this company, whose works are amongst the largest at Sheffield, announce that the accounts for the year ending December last show a balance available for dividend of £62,495. This, however, includes a balance of £17,389 brought forward from the previous year. They recommend a dividend of 5 per cent, which will absorb £40,000, and carry forward to next year a balance of £22,495.

Claim for Damages.—On Friday last, at an Under Sheriffs' Court held at Cardiff, Mr. Morgan, a sculptor and saw-mill proprietor, carrying on business at Merthyr, claimed £3680 from the London and North-Western Railway Company for damages alleged to have arisen through a subsidence of ground under his property caused by the defendants' tunnel. Conflicting scientific evidence was given, and the jury found for the plaintiff, awarding £950 damages.

South Kensington Museum.—Visitors during the week ending 13th March:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 11,261 - Mercantile Marine, Building Materials, and other Collections, 1455. On Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 5 p.m., Mueseum, 1741; Mercantile Marine, Building Materials, and other Collections, 69. Total, 14,526. Average of corresponding week in former years, 16,097. Total from the opening of the Museum, 18,760,327.

Sections of Rolled Joists, &c.—Messrs. Measures Brothers and Co. have just issued a new sheet of sections of joists, girders, fire-proof floors, &c. Some of the former are larger than are usually kept in stock, and the firm state that the whole of the accompanying calculations as to strength have been carefully revised so as to give the safe distributed loads, and that, as far as it is possible to ascertain by calculation, verified by numerous actual tests, they are thoroughly reliable. Every section of joists, they add, has been loaded by dead weight to above the indicated load without any material deflection; and in no case where they have been loaded to four times these indicated safe loads has the joist broken or failed to sustain the weight.

Curious Law Case.—On Thursday, last week, in the Chancery Division of the High Court of Justice, was heard a motion in the case of the Egremont Burial Board against the Egremont Iron Ore Company, for the production by the plaintiffs of certain documents before the defence was put in, an application in Chambers having previously resulted in no order being made. The motion was supported by Mr. Whitehorn for the defendants, and opposed by Mr. Bristowe for the plaintiffs. It was stated that the defendants, in the course of working for hematite ore, had let down the bodies from the cemetery into their mine. The plaintiffs did not come for an injunction when the application was refused in Chambers, but Mr. Whitehorn admitted they would be entitled to an injunction, to which the defendants would submit at once if they found by the production of the documents that the minerals were not reserved, and that the plaintiffs were entitled to the land down to the centre of the earth. Mr. Bristowe maintained that the plaintiffs could not be called upon to discover the documents till after the statement of defence was put in. The motion was refused with costs.

The Darlington Iron Company (Limited).—The annual report of this company has just been issued. It states that the directors are glad to state that after the payment of £3408 15s. 6d. for interest on unpaid purchase moneys, &c., the results of last year's operations show a balance to the credit of profit and loss of £431 12s. 2d., thus reducing the balance of the debit of this account to £19,908 7s. 11d. The directors hope that the result will be regarded as satisfactory, bearing in mind the distressed condition of the trade during the greater portion of the year, and that no improvement was experienced until about September or October last. The necessary plant had been erected for the manufacture of Bessemer steel, and this new branch of business was expected to be commenced during the ensuing month. The directors are glad to report that there is now a good demand, both for iron and steel rails, at remunerative prices, and all the departments both at the Albert Hill and Springfield Works are being put into full operation as rapidly as possible. Some modifications of the term with regard to the unpaid purchase money due to Mr. Barningham, the vendor, had been agreed upon, and an arrangement of a satisfactory character made. Colonel Beaumont, M.P., the retiring director, was eligible for re-election.

The Western and Brazilian Telegraph Company (Limited).—This company which holds a concession from the Brazilian Government ending 1933, and works at present a total length of nearly three thousand miles of cable between the principal ports of Brazil, with a total capital of about a million and a half fully paid, is about to issue £250,000 6 per cent, B debentures, secured by a mortgage on the property of the company, and ranking next after its £200,000 of A debentures. In a statement just issued by the directors the following details of the company's position are given.—The receipts for the first twenty-two weeks of the current year as published (viz. 1st October, 1879 to 28th February, 1880) average £2833 per week, being at the rate of £147,300 yearly, and are in the aggregate £8466 in excess of the highest of receipts for the corresponding period of any previous year, leaving (after payment to the London Platino Brazilian Company) £117,840 as the revenue of this company. After deducting from this amount the £12,030 per annum interest on the A debentures, and the £15,000 per annum required for the interest on the present issue (together £17,000), there would remain £90,840 to meet the working expenses of the company, and for payment of dividend on share capital.

Forging Iron Brands.—At the Birmingham Police Court on Thursday last week, Mr. George Bond Smith, a partner in the firm of the Portland Bolt, Nut and Rivet Company, Brookfields, Birmingham, and Mr. Zachariah Clay, of the firm of Clay Brothers, Rowley, were summoned for conspiring together to manufacture and dispose of certain rivets stamped with the words "Low Moor," as rivets made of iron manufactured at the Low Moor Ironworks, when, in fact, they were made of iron of a different manufacture and of an inferior quality. The prosecution was conducted, on public grounds, by the Low Moor Company. It appeared that the defendant Smith was under a contract to supply Messrs. Stothert and Pitt, engineers, Bath, with rivets made exclusively of what was known as Low Moor iron. Smith wrote to the Low Moor Company, but they declined to supply him, informing him that he must get it through their merchants at Birmingham. Thereupon Smith wrote to Messrs. Stothert and Pitt, stating that, if agreeable to them, he would prefer to use Bowling iron instead of Low Moor. Messrs. Stothert and Pitt replied to the effect that their instructions were to use the Low Moor rivets, and as they were executing a Government order they did not care to deviate from the specification. It was alleged that Smith then went to Clay and arranged with him to manufacture the rivets of Lord Dudley's "treble best" iron. Clay, unknown to Smith, was unable to obtain "treble best" iron, and manufactured the rivets of "single best" iron. These rivets were supplied to Messrs. Stothert and Pitt, stamped with the Low Moor mark, and were used in the Government contract. It was afterwards found that they were of inferior quality, and Smith was informed that at least 20 per cent. of the rivet heads had fallen off. The facts were not denied by the defendants, but it was urged that there was no fradulent intention in what they had done, and they derived no pecuniary profit from it, their only object being to expedite the completion of the contract in obedience to the wishes of Messrs. Stothert and Pitt. The defendants were prepared to pay all expenses and whatever loss had resulted from the supply of inferior iron; also to make an ample apology, and pay a handsome sum towards any charity that might be decided upon. The stipendiary magistrate said that the Low Moor Iron Company had behaved with great forbearance, and he thought the justice of the case would be met by the defendants paying the expenses of the whole transaction, giving an ample apology, and paying £50 towards some charity. It was ultimately decided to present the £50 to the Women's Hospital.

AMERICAN GLEANINGS.

Trades Unionism in the United States.—Several thousand colliers are on strike in the Clearfield bituminous coal region of Pennsylvania. An extensive puddlers' strike for 20 per cent. advance in wages also began on Monday at the mills in the interior of Pennsylvania. Fifty-seven mills, employing 7000 workmen, will probably be involved in the strike.

Agriculture v. Gold and Silver Mining.—That agriculture is the basis of all prosperity is generally conceded, and the current statistics give emphasis to the facts. Thus while the estimated yield of the American gold and silver mines during the twenty-seven years from 1849 to 1875 was $1,617,000,000, the value of the leading agricultural products of the single year 1877 was $1,594,000,000 in round numbers. In other words, the farmer in a single year extracted nearly as much wealth from the soil, as the miner obtained in twenty-seven years of mining activity.—*American Mining Journal.*

Defunct Railway Securities.—If your father, advises the *Railway Review*, ever held any defunct railway securities, go through your trunks and drawers and bring them out. Six months ago a Boston capitalist, in a good-natured manner, threw a package into his son Charles' lap, remarking that "there is a package of railway bonds, the face of which is $30,000. As they will never be worth anything in my day, you may keep them for your children." Charley put them in his strong box and forgot all about the transaction. Thursday of last week he thought he would look and see what these bonds were, and after ascertaining their title he was informed by a broker that they were worth just $27,750.

Importation of Pig-Iron.—According to the United States Bureau of Statistics there were 533,432,470 pounds of pig-iron imported in the first eleven months of last year, which is equal to 238,139½ tons of 3240 pounds. The value is given as 4,157,851 dols.—equal to 1746 dols. per ton. This average price for the eleven months is, however, a great deal lower than the present value, the price of Scotch pig on the other side at the close of last month beginning about 20 dols. per ton. Since our last issue 1000 tons of Eglinton pig-iron was sold in Pittsburgh at 42 dols. cash. At latest accounts freights on pig-iron from Glasgow to the United States were 1s. 6d. Four or five months ago pig was carried at nominal rates as ballast.—*American Manufacturer.*

Extensive New Steel Works in Chicago.—The iron and steel industries of the West are about to receive an important accession in the works which the North Chicago Steel Company are to build at once at South Chicago. The parties interested are substantially the same as those composing the North Chicago Rolling Mill Company, which has reached the limit of its capital. Seventy acres of land have been purchased on the lake shore immediately north of the piers of Calumet Harbour, having a river front with excellent harbour and docks of 2500 feet, and a lake front of about three-quarters of a mile. There are to be erected four blast-furnaces, a Bessemer converting works and a steel-rail mill—all to be completed by July, 1881, and costing altogether $2,000,000. The works will be within a mile of four trunk lines—the Baltimore and Ohio, Lake Shore, Fort Wayne, and Rock Island—and within two miles of the Illinois Central and Michigan Central, and will be connected with them. When running, full 2000 men will be employed, and 90,000 tons of steel rails will be made in a year.—*Chicago Railway Review.*

A Log Railroad.—A log tramway or railroad in use by the Richardson Brothers at their mill, south of the Truckee is a very ingenious piece of machinery. Logs ten inches or a foot in diameter, are hewn round and smooth and their ends are coupled together by iron bands. These logs, laid side by side upon graded ground for a distance of perhaps three miles, form the track. Of course the road looks quite like an ordinary railroad track, except that logs are used instead of rails, and the ties are at much greater intervals. the wheels of the engine and cars are concave on their outer surface and fit the curve of the logs. The power is applied to a wheel in the middle of the forward axle on the engine. The most remarkable loads of logs are hauled upon the cars, and the affair is a decided success. It is very cheap, its construction is simple, it is not easily damaged, and its operation is all that could be desired. By means of this log railroad the Richardson Brothers are enabled to get their logs to the mill from the forest, three miles distant, at a cost far less than it is ordinarily done.—*Truckee (Nev.) Republican.*

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—There is very little new to note respecting the iron trade in this district. Most of the works are kept fairly going, but there is scarcely so much doing in some branches as was the case a few weeks ago. The demand for manufactured iron is such that the mills and furnaces are well worked. Pig-iron displays a good deal of activity, the full complement of furnaces being kept in blast. Makers of Bessemer steel rails, tires and axles are well off for orders, and the works at Penistone and elsewhere in the district are employed full time. A good deal of activity is displayed by waggon builders throughout the district. The coal trade is still very quiet, and there is but a limited demand for house-coal, considering the cold nature of the weather. The chief of the pits are still not making more than three or four days per week. There can, however, be no denying the fact that owing to the vast output which the district collieries now yield even the few working days more than suffice to meet the demand. The tonnage to London is very moderate; the high tonnage rates demanded being said to be the chief cause. The Manchester, Sheffield and Lincolnshire Railway Company, which collects the coal in the district and forwards it to Doncaster for the Great Northern, is conveying but a moderate tonnage of house-coal; but on the other hand they are forwarding a fair quantity of steam-coal to Hull by the North-Eastern, as well as to Keadly and Grimsby by their own route. The latter class of trade is expected to improve, seeing that the Baltic ports are now navigable. There is also a fair enquiry for hard coal for smelting and other purposes, which has a tendency to somewhat improve the low prices which prevail. Small coal and slack are better to dispose of owing to the large demand which exists for coking purposes, and the somewhat improved demand for Yorkshire and Lancashire. The make of coke was scarcely ever so large, yet more ovens are either in course of erection or contemplation. The Yorkshire and Derbyshire Coal and Iron Company (Limited), who own the Carlton Main Colliery, have resolved to erect a number of ovens for the purpose of engaging in the trade. Those at North Gawber are being augmented, and in a short time the firm will be able to supply over 60 tons per day.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—A quieter demand exists for hematite pig-iron, and during the past few days business has been slow. Merchants and holders of second-hand parcels generally are doing the greater bulk of present business; and it is observable that makers refrain from quoting in many instances as they think when second-hand parcels are disposed of, and they do not represent a considerable tonnage of iron, prices will again advance with an improved demand in spring. There is a fair demand from the Continent, but the American demand is inconsiderable. Large deliveries have to be made, however, to America and the Continent this year; and several parcels of considerable magnitude have been bought for the Colonies. The output of pig-iron has again been further increased, and confidence in a brisk trade during the year is shown by the preparations which are being made with all despatch to put in blast new furnaces, and to relight old ones. The value of pig-iron, so far as present sales are concerned, has been reduced to £5 5s. per ton for all-round Bessemer qualities, and to £5 per ton for forge qualities; but it is noteworthy that makers of pig-iron decline to sell for forward delivery except at £6 per ton. Steel-makers are very busily employed, and have in hand a large number of orders, both on home and foreign account; and, during the past few weeks, several inquiries have been made for new deliveries. Prices range from £10 to £11 per ton for steel rails. Merchant qualities are in steady request. Shipbuilders are more busily employed, and are likely to have an active summer. Engineers, especially in the marine department, are busily employed, and are in receipt of several inquiries for new work. Railway rolling-stock works are full of orders, and boiler-makers and others employed in the minor industries of the district have practically their hands full for some months. A weaker tone is observable in the iron-ore trade; and although raisers, in many instances, have sold the whole of the output of their pits up to the close of the year, prices are weaker, and ore is offering at from 25s. to 28s. 6d. per ton. Coal and coke steady.

BIRMINGHAM.—Although it is generally recognised that the turmoil of the general election must exercise its customary influence in checking the development of trade, it is too early yet too feel any of the ill effects of the interference with the ordinary course of business. In fact, what little change has to be noted in this respect is in the direction of increased activity, factors and manufacturers being alike anxious to push forward orders in hand, and get them out of the way before we are in the thick of the contest. The local hardware manufacturers report a continuance and slight extension of the activity in export trade which has previously been adverted to as having set in. The South American markets especially are furnishing some very good orders, and Brazil has taken a fair supply of edge tools, plated goods, and certain descriptions of tinware, and the latest advices from Paraguay and the River Plate district are also favourable. A recovery is reported in the trade of Monte Video. Indian orders for the heavier classes of goods continue to come in pretty freely, while carriage ironwork, harness. saddlery, &c., are in good request at the Cape, and from New Zealand, advices which show a considerable improvement come to hand. The indents from the North of Europe generally are not so satisfactory as was recently anticipated, the Russian trade being decidedly flat for the season, and Canadian orders do not reach anything like the volume which manufacturers had fair reason to expect. In the home trade the leading feature is still the want of any animation in the agricultural districts, orders being simply for bare necessities, and extremely limited alike as to number and value. Owing to the continuance of fine open weather, builders have begun to move, and both from the metropolis and the leading centres in the provinces orders for ironwork, fittings and builders' ironmongery generally are being booked somewhat freely and for considerable quantities of goods. A fair request has also sprung up for constructive ironwork for railways, as well as for carriage fittings and boiler tubes. An improvement is likewise reported in the demand for plain tinware, and stamped goods, but tinplate workers and japanners generally find business checked by the recent rise in raw material, the heaviness of retailers' stocks and a general complaint of scarcity of money. The demand for bath and toilet ware is classed below the season's average. One or two of the large local factories in the watch trade who turn out machine-made watches on the interchangeable system have been doing pretty well both in the home and export trade. The jewellery trade is reported quiet, and the same may be said with reference to the electro-plate branch, although one or two firms are fairly well employed on specialties. Although nickel is in limited request for the home market, considerable quantities are being sent out to the Eastern market, and both nickel and German silver are selling well for export. The Birmingham manufacturers of brass and copper wire, tubes, &c., have reduced prices of brass and copper goods one farthing per pound, and in view of this drop a similar movement has since been made by the firms of the Wolverhampton district. In the local iron trade business continues quiet, but as makers are not yet pressingly in want of orders, quotations have not varied so far as the best makers are concerned, although some of the second-class firms have shown a disposition to give way. In the export market the chief features have been the despatch of fair quantities of nail-rods to China, hoops to Egypt, India, and America, rods to the Cape and the Australian colonies, and galvanised corrugated sheets to South America. Orders are not coming to hand very freely just at present to renew those worked off. The home trade is dull, although an improved request has been manifested for boiler and girder plates for engineers and ironfounders, and the various railway rolling stock works are also taking iron in fair quantities for their requirements.

Thursday Evening.—More animation on 'Change today, owing to orders from colonial markets, where stocks are getting low. Galvanised iron rails and fencing-rods in chief request. In home trade no improvement manifested. Manufacturers still fairly employed on old contracts at low prices, but find it difficult to secure orders at new rates, more especially because of underselling by merchants and brokers, who overstocked themselves early in the winter. High-class iron maintains its value: hot-blast pig at £4 10s., and marked bars at £9. For other descriptions the market is weak and variable.

CLEVELAND.—There was but an average attendance on Change at Middlesborough on Tuesday, and business was dull, "bears" having done their best to take advantage of circumstances. There was great excitement but that was over the probabilities of the approaching election. All the disposable iron is chiefly in second hands, the makers being well sold and not much more than able to keep up to contracts. No. 3 may be quoted at 53s. to 53s. 6d. and 54s. over the next four months. The finished-iron trade is not quite so brisk and the prospect is rather duller than formerly, but such reactions are natural and perhaps more healthy than that state which accompanies higher prices. Engineering is busier and the minor industries depending thereon. Coal and coke are much the same.

DERBYSHIRE.—There is very little new to note respecting the coal trade of this locality. The pits are working more regularly than those in some parts of Yorkshire, owing to the fact that the owners were willing to enter into large contracts at very low prices towards the close of last year. The tonnage to London and the South is well sustained, and last month there were sent from Clay Cross, Langley Mill and Eckington something like 52,000 tons; whilst a dozen firms engaged in the coal trade in Derbyshire and Nottinghamshire sent over the various lines 128,000 tons during the month. There is a fair inquiry for steam or hard coal for transit and smelting purposes, but prices do not materially improve. Engine fuel is in better request than it was a short time ago, owing to coke-making operations being largely prosecuted in the district. The output at the present time is large, having been materially increased since the improved state of the iron trade set in. There is very little alteration in the lead-mining operations carried on in the county. The iron trade continues in much the same state as when last noticed. The works are kept fairly going, and there is a moderate business doing in manufactured iron. Makers of pig-iron continue to produce a large output, most of the available furnaces being in blast. Active preparations are being made to put in an efficient state of repair two furnaces near Ambergate, which will be blown in as soon as possible.

DURHAM.—The quietude lately reported in the iron trade has deepened, and as prices of pig-iron are going downwards both at Glasgow and in Cleveland, there is a feeling of insecurity compared with what was the case a month or two back relative to the prospects of the trade. At the same time the best authorities do not regard the relapse as of a serious nature so far. Danger has long been known to exist from the over speculative element which appeared in the trade both in England and America, and at the first indication of a lull in business speculators are largely placed *in extremis*, and the more timid and weaker of them rush into the market and precipitate the very evil which they would wish to avoid. Prices of Scotch and North of England iron have thus been considerably run down until the quotations given for forward delivery are 8s. to 10s. per ton below those of a month ago. This class of sellers at present have the market in their own hands, and are the only ones who give prices, as makers and stronger holders will not sell. The quotations ruling, therefore, under the conditions named, are about 54s, 6d. to 55s. No. 3. Odd lots are sold for less. Forge pig at about the same rates, with very little, however, offering. Manufactured iron is partaking of the depression, and is lower in price. Bars are £7 15s. to £8 for common qualities, ship plates £8, 15s. to £9, and angles £8 to £8 5s., less 2½ per cent. The elections, amongst other causes, help to put a damper upon trade. The report of the Darlington Iron Company (Limited), which has been issued this week, though not a very encouraging document, retrospectively considered, speaks with confidence and hope for the present year. The profit made by the company was under £4000 for last year, and after paying interest, the balance of loss of the company is reduced to rather less than £20,000. The company expect to start their Bessemer steel plant next month, and report a good and remunerative demand for iron and steel rails. At Stockton the ironworkers stopped one of the works because they had a strong antipathy to the foreman of the works. The ironworks are well employed, as also the large engine and other works in the northern part of the county, including the iron shipbuilding establishments. Some of the Tees shipbuilders have arranged the dispute with their workmen, and it is expected that this course will be generally followed. The works of Bolckow, Vaughan and Co. (Limited), the Consett Iron Company (Limited), and others are fully employed. The house collieries have been rather slack in some parts of the county. A steady demand has existed for manufacturing coals, at 5s. to 6s. 3d. per ton at the pits. Coke is better to buy by about 1s. per ton, and more in some cases, owing to the less satisfactory condition of the iron trade.

FOREST OF DEAN.—The staple industry of the Forest (coal) continues to be devoid of improvement, and general complaint prevails, excepting in the case of manufacturing classes, for which the enquiry holds fairly good. In respect to house-fuel, the demand is no more impregnated with life than is the case at midsummer. Very little coal passes over the new Severn bridge, and it is feared that some time must elapse before any substantial trade is likely to become developed. It is stated that this was the experience in respect to the docks at Sharpness adjacent to the bridge, and that at least a couple of years expired ere a material trade was created. The intimation given last week applying to the Parkend Collieries Company has now been verified by fact, and a stoppage has taken place at the various works of the firm. Any prolonged stoppage will be, it is feared, ruinous for the district in its various applications. A meeting of the proprietary has been fixed for Thursday, the result of which has not yet transpired. It was intimated a few days ago, on good authority, that the stoppage would not be attended with any prolonged cessation of operations. At Messrs. Crawshay Brothers' collieries, a proposition has been submitted to the coal-cutters involving the supply of 21 cwt. instead of 20 cwt. to the ton. It is obvious that with the thin measures of the Forest—notwithstanding the compensation by nature in regard to a superior class of coal—the proprietors must seek some other relief, as in universal bad times like the present consumers are obliged to content themselves by obtaining their supplies, not so much for high class as cheap fuel. The question of increased hours has been spoken of in the Forest as one of those matters which, before long, will have to be practically dealt with. Indeed, there are abundant evidences arising to manifest the necessity of proprietors obtaining some relief. The pig-iron trade is hardly so brisk, and stocks are heavier. Makers state they are well sold ahead, and they are by no means apprehensive of any material giving-way of prices. There can be little doubt that quotations were advanced out of all proportion to possible continuance. In the Forest the flight in seven or eight months was from £2 14s. to £6 10s.. It is extremely questionable if Forest pig has fetched the higher figure, although circulars issued in February indicated the March prices for No. 3 brand would be £6 10s. per ton. There is a good demand for local iron ores, and everywhere the mines are being re-opened. Tin plates and iron wire continue in active request.

GLASGOW.—The warrant market has steadily declined this week, a considerable business has been doing daily, as holders who bought at the high prices have been forcing their iron upon the market, enabling the "bears" to cover themselves and prices to keep falling at the same time. There is a decided lull in shipping orders; a few have come from Canada, but the United States has almost ceased to buy pig-iron, rails or scrap, though what they have already bought is being rapidly shipped to them. Last week about 9000 tons of Scotch pig-iron were shipped to America. There is now a much better demand for No. 3 g.m.b., to take the place of Middlesborough iron; but this will not affect prices much, as the stocks are so enormous, while another furnace has been put in blast, making 115 in all, against 90 at this time last year. On Thursday business was done from 59s. 7d. to 58s. 6d. cash and 60s. to 59s. a month, fluctuating next day between 59s. and 59s. 7½d. cash and 59s. 6d. to 60s. a month. On Monday 59s. to 58s. 1½d. cash and 59s. 6d. to 58s. 9d. a month was accepted, dropping on Tuesday to 56s. 6d. cash and 56s. 7½d. a month. On Wednesday prices fluctuated between 56s. 6d. and 57s. 6d. cash and 57s. and 57s. 9d. a month. Closing Buyers 56s. 9d. cash, and 57s. 3d. a month, sellers 1d. per ton more. The shipments of pig-iron from Scotland last week were, foreign, 16,612 tons, coastwise, 4373 tons; total, 20,985 tons, against 10,743 tons in the corresponding period of last year. The total shipments since Christmas show an increase over last year of 56,332 tons. The imports of Middlesborough iron into Grangemouth last week were only 660 tons, against 5080 tons in the corresponding period of last year. The total imports till March 13th, 1880 are 57,382 tons, against 55,608 tons till March 15th, 1879. The stock of Scotch iron in Connal and Co's store now amounts to 442,497 tons, and this week a few tons daily is coming out of store in excess of what is being sent in. The malleable works are busily employed, but are getting well through their orders. New inquiries are very scarce, and considerably lower orders are being submitted to in order to obtain orders. The exports last week were considerable, including cast-iron goods to the East valued at £10,591, wrought-iron at £1059, machinery and locomotives at £7779; for Natal, cast-iron goods at £3258; for the United States, wrought-iron at £1670; and for the Continent, sewing-machines at £3170. Shipbuilders are not getting hardly any new orders, and engineers and founders are quiet, as buyers all seem inclined to hold back their orders. The coal trade shows no sign of improving, as prices of Lanarkshire coal are too high.

LANCASHIRE.—The amount of business doing in the iron trade of this district continues of a very limited character, buyers naturally, in the face of a falling market, holding back their orders as much as possible. The local enquiry during the past week has been very small, consumers in Lancashire being pretty well covered for the present and under existing circumstances not caring to buy at all speculatively, whilst temporarily there seems to be almost an entire suspension of the American demand, but as American agents here are anxiously watching the market, it is generally believed there are considerable orders to give out, which will be placed as soon as it is seen that prices have touched their lowest point. Although there is but little business doing in local pig-iron so far as new orders are concerned, Lancashire makers continue firm at 70s. per ton less 2½ per cent. for delivery into the Manchester district, as they entertain a strong conviction that the depression is only temporary owing to speculators forcing second-hand iron upon the market, and they are willing to wait. Very much the same may be said with regard to the attitude taken by makers of outside brands coming into this district for although there is a good deal of iron in merchants' hands which is being offered at figures that keep producers altogether out of the market, g.m.b. being offered for prompt delivery equal to Manchester at as low as 63s. 4d. per ton net cost and Lancashire iron at under 70s. per ton less 2½. Most of the makers are still firm in asking about late rates. Second-hand lots of finished iron being offered for immediate delivery at all sorts of prices by merchants whose time for specifying has run out. Middlesborough bars delivered into the Manchester district have been offered at under £8 per ton, and local bars at from £8 to £8 5s.; but Lancashire makers are still asking £8 10s. to £9 per ton, and most of the forges are still very full of orders. In the foundry, engineering and machine-making branches of trade a partial improvement is reported, and boiler-makers generally are busy, but there are still many complaints of the low prices at which orders have to be taken, as compared with the cost of raw material. In the coal trade business continues in a very depressed condition. All classes of round coal are moving off very slowly, and stocks are accumulating; whilst in the principal colliery districts very few of the large pits are running more than half time. There is a continued downward tendency in prices, colliery proprietors being willing to take considerably under the list rates to move away stocks. For best Wigan Arley, not more than 8s. to 8s. 6d. per ton is now being obtained at the pit mouth, and for common sorts, in some cases, less than 6s. per ton is being taken, with good Pemberton from pit averaging about 6s. 6d., and common round coal, for steam and forge purposes, 5s. to 5s. 6d. per ton. Engine fuel continues very firm, and for good slack, which is scarce, 3s. 6d. per ton is readily obtained at the pit mouth. The shipping trade is extremely dull, and very few cargoes have been offering during the past week, whilst coal which has been sent on speculation has been pressed upon the market at very low figures.

LEEDS AND WEST YORKSHIRE.—Our common iron makers are full of work to the top of their bent and the production of manufactured best Yorkshire iron goes on steadily. The outlook of neither of these branches is perhaps quite so well up to the mark as recently it appeared likely to attain to, but that springs, it is thought, from the disturbance which has taken place in the market for raw material. The prices of common iron have been shaken slightly, but the quotations for railway and shipbuilders' work made of the best Yorkshire iron are as firm as a rock. Generally speaking, however, the iron trade here as elsewhere has not so much brightness about it as it had a month ago. Those who have been forestalling the market have not yet found a way out of their complications. Their specifications are invariably rejected by makers. They are waiting on, however, in the expectation that an ebb-tide setting in from America will give them an opportunity to recoup. The Aireside Hematite Iron Company have now their works in full operation again. All their three large furnaces are in blast turning out great quantities of ordinary hematite pigs. At these works the conversion of slag into various architectural purposes of every-day work is carried on largely, and certainly as successfully as at some similar establishments much boasted of in more northern localities. Engineers in almost every branch of work are well off for engagements. It begins to be more than ever evident that some of the railway companies had withheld ordering new plant so long as it was in the least possible to do so consistently with their duty to the public. Believing, however, that the buoyancy of their traffic returns is a reality, they have at last distributed nine good orders for locomotives among several firms in this districts. At some engineering establishments there is still "ample room and verge enough" for far more work; but no one is so ungracious as to complain if but a smaller share of work has fallen into his lap than it has been the good fortune of a few others to acquire. Large machine tools of improved construction, and adapted to overcome novel difficulties in connection with great mining and sanitary undertakings are finding employment for numerous hands. Any demand for tools of less importance can mostly be supplied from stock. The coal trade keeps flat, and prices are low, both for the manufacturing and the domestic article.

LONDON.—The metal market here manifests signs of weakness, and small holders of middle parcels are further inducing depression by pressing to realise their profits or losses. In the pig-iron trade we have a fall of some 4s. 6d. since our last issue, and tendencies at present do not point upwards. Warrants close 56s. 10d. Manufactured iron slightly easier. Copper flat: Chili bars, £66 10s.; Australian easier; English ingots, £74. Tin quiet: foreign lower; closing price, £88 5s. English ingots hold their own; £93 to £94 for ingots. Lead.—This market shows more signs of depression; the building trade here does not seem to affect prices for the better, and manufacturers are sadly complaining. English pigs, £17 10s. Tinplates easier, with few inquiries, but brisker business is looked for shortly.

NEWCASTLE AND THE TYNE DISTRICT.—The general election takes the attention of business men here, and it operates to no little extent as a hindrance to trade in some directions. Candidates for all the constituencies in this locality are daily to be seen on 'Change, and conversation turns more frequently on the qualifications of these gentlemen and the probable issue of the election than on contracts and charter parties. Business, indeed, is for the moment slack; but this state of things, it is confidently hoped, will be altered as soon as the political excitement comes to an end. Trade in pig-iron, influenced by the flatness that prevails in the Scotch market, has been decidedly weaker during the past few days. No. 3 sells at 55s., and No. 4 forge at 56s. There is little change to note as regards manufactured iron. Ship plates meet a fair, steady demand at £9 to £9 5s. per ton. Forge work is much in request at present, both for ship and locomotive purposes; it is long since the owners of forges could so readily obtain orders for such heavy work as stern-posts, rudders, screw-shafts, keel bars, &c., as they can at the present time. The manufacture of rivets, bolts, nuts, &c., is also in a healthy state of activity. The works of the Tyne Bolt and Rivet Company are exceptionally well employed. In the shipbuilding yards of the Tyne the most assuring evidence of the revival in trade generally is seen in the demand for new vessels of all descriptions, and in the eagerness of the various firms to get contracts finished and other work begun. All classes of workmen in this branch of industry are contented, and certainly much more diligent than they were as a body during the inflated prosperity of 1871-4. Some of the firms show an inclination to give employment to the rather numerous class in this district of shipwrights (*i.e.*, builders of wooden ships), whose occupation is now almost gone, and this frequently gives rise to commotion and grumbling amongst the iron men; but as far as wages are concerned they are satisfied. At the establishment of Messrs. C. Mitchell and Co., at Low Walker, there has just been launched a twin screw-steamer barge, named the *Tomsk*, which, along with a sister vessel, the *Imsk*, have been constructed for Messrs. Wm. Milburn and Co., of Newcastle, London and Odessa, to facilitate the despatch of their fleet of steamers when loading in the Sea of Azov. They will carry 500 tons, and will only draw 6 feet fresh water when laden. Messrs. Wm. Milburn and Co. have also two steamers capable of carrying 3200 tons dead weight almost ready for launching from the building yard of Messrs. A. Leslie and Co., at Hebburn; they are for the American trade, and are to be of great speed. At Jarrow, Messrs. Palmer's engine works are full of work, and the boiler department is also extremely busy. The same encouraging condition of affairs exists at the leviathan engine and ordnance works of Sir William G. Armstrong and Co., at Elswick. In our coal trade the situation is little, if at all, changed since last week. Most of the fitters of the best steam-coals have the same regular demand, but in some quarters business is somewhat weaker. The best quality of Hartley's is nominally quoted at 10s. per ton (but it has touched 10s. 6d. since last autumn); contracts are, however, pretty freely entered into at 9s. 6d., and secondary sorts can be had for 9s. Gas and coking coals are not difficult to sell at 7s. 6d. per ton, less 2½ per cent, but the Baltic trade not having opened yet, and the demand for London having considerably fallen off, it cannot be said that gas-coal mines are working to their full capacity, although they are little short of it. House-coals are still inactive, and prices have to be relaxed to secure sales of any large quantities. Coke is in good request at 18s. to 20s. per ton. The chemical market has improved very much this week. More orders are on hand, and shipments are better. Copper, which recently receded in price, has recovered about 30s. a ton; new copper works are approaching completion at Wallsend. Lead works continue very busy. Other branches of industry call for no special remark.

NORTH STAFFORDSHIRE.—There is very little change to report in the condition of the finished-iron trade of this district. The merchant mills are fairly employed on the orders entered some time ago, but new transactions are scarce, and at present there are no indications of a speedy revival of the demand. It is true that a number of inquiries are being made, but as makers are reluctant to reduce prices they are invariably withdrawn, and will no doubt be held back until quotations are more favourable to the buyer. For the present there is no necessity for manufacturers to show any anxiety to secure orders as they are supplied for some weeks to come, and it is thought that by the time they are in a position to take new contracts buyers will be forced to place, even if rates are not lowered. Prices, if not so firm, are not dropping very much. There has been a great falling off in speculative buying since the change in the market, which is in the manufacturers' favour, notwithstanding that merchants are purchasing cautiously and the hope that quotations will take a downward direction before long. A good many orders for the larger sections of iron have been received, and rather more animation pervades the plate trade. Hoops also are in fair demand. The pig-iron trade is rather better, and prices of well-known brands are well maintained, but inferior makes are selling at low rates. A steady business is doing in ironstone. No improvement in the coal trade is noticed. The sale is inactive and prices low. Some of the pits are well employed, but others are not working more than half time.

SHEFFIELD.—There is very little alteration to note in the condition of trade in the town and district. It is very evident that the general election is preventing the placing of orders and interrupting business. In the iron trade matters have been rather flat during the past few days, and we cannot hear of any fresh orders of magnitude having been placed. The mills, however, for the time being, are fairly engaged. At some of the works preparations are being made for a more extensive output of material, both iron and steel, and it is evident that a heavy amount of business in these trades is expected. In the plate department some of the masters are extraordinarily busy on ship and boiler plates. These orders are for the most part coming from the north, and an improvement is noted in that direction. Prices are quiet at the rates of last week, and for the moment it is difficult to check a downward movement in the market. The fact that some of the largest houses are buying irons forward does not forecast a continued depression. Derbyshire irons are selling freely, and it is surmised that prices will increase in the course of three or four weeks, when business has resumed its ordinary routine, and the heavy settlements on last autumn's purchases have been effected. Bessemer steel is very firm. The drop of £1 per ton in marked ingots which took place last week has been got over, and £11 per ton is again quoted for best lots, sellers refusing to book forward at the rate. Already there are signs of disturbance in the trade, for the men are demanding higher wages, and at one or two places have been met with an unexpected bar—notice to quit. There are plenty of "hands" at present procurable, and a speedy settlement of these almost universal adjuncts of improving business is not improbable. The coal and coke trades are particularly flat, without any signs of improvement. Coal for manufacturing purposes is more inquired after than any other description. The fact, however, that most of the largest consumers now own their own pits, has prevented any fear of a "famine" through coal combinations, and at the same time has hindered any accessions of prices. The men have adopted a sliding scale which they believe will operate to their own benefit—should prices increase—but at the present time the latter would appear a remote contingency. The cast-steel trade is improving but very slowly, and we do not note that the leading houses are increasing their prices. This is to be accounted for by the fact that large stocks had accumulated during the past few years, and holders are only too glad to get rid of the material at the high rates charged for leading qualities. Contracts which have been entered into for the supply of Swedish iron during the next two years, however, imply that a reaction is anticipated. Stocks are slowly but surely being worked out. The amount of work doing in the mills shows that a healthy demand is experienced even for high-class steels, which for a long time past have been almost a drug in the market. A heavy weight of orders has, during the past few days come in from Australia for second-class cutlery, but prices are much cut up by competition. Well-known makers require advances of price on account of increased cost of production. Rubbishing goods are being sent out in large quantities for the time being, but the trade are aware of this, and before long we may hear of a genuine improvement both as regards demand and quotations. Razor makers are especially busy, but in other branches there is only a very slight alteration to note.

SOUTH STAFFORDSHIRE.—The disturbing influence of the general election has not, so far, materially affected the amount of business doing in this district, and the orders which home travellers are sending in are up to the average of a few weeks ago. Makers hereabouts, in sympathy with the Birmingham houses, have notified a reduction of one farthing per pound in brass and copper goods. A drop upon the recent maximum of 10s. per ton is asserted by the firms who use iron for hardware purposes to be all that can be reported. Small hardware manufacturers are mentioned who have begun to accept the old and unremunerative prices which ruled before the revival began, but even with this concession they are not able to report any marked addition to the number of specifications upon their order books. In the galvanising and japanning branches prices remain unaltered. The principal mail this week is that from New Zealand, which has a fair amount of indents, and which is regarded by manufacturers as satisfactory. The orders comprise a wide selection of general ironmongery goods. As to India, a more hopeful future is looked for than has been noticeable for some months past, and orders are more bulky than of late. The iron trade is without much alteration. Prices are upon the basis of £8 10s. for medium bars and £9 for marked bars. Sheets (singles) may be procured at £10 10s. Galvanised sheets of the "crown" brand of 24 w.g. are £20 10s., and for 26 w.g. £22 10s.

WEST CUMBERLAND.—There is a quieter demand for hematite iron, although there is nothing to indicate that there is any probability of this affecting the industrial position of the district, which is very active. Makers of all qualities of iron are very busy, and hold large delivery engagements. The sales at present are not very considerable, as there is not only a lull in the home but the foreign demand. Speculators are, however, clearing out their stocks, and they are accepting reduced prices. For instance, forge iron was sold last week at £4 17s. 6d. per ton at makers' works, and Bessemer qualities at about £5 per ton. But makers decline to do business at these prices, except in isolated instances, because they have as many orders in hand as will furnish them with employment till a return to a better demand and better prices is brought about. Numerous enquiries are being made, and there is every probability of a very active season with the Continent, the colonies, and with America. Large consignments of metal are being shipped for South Australia, and a very considerable tonnage of iron and steel has to be shipped during the year from local ports to all parts of the world. The steel trade is very busily employed, and the output may be roughly stated for the district at 3000 tons weekly. It is expected that in a short time the tonnage of output will be increased. Shipbuilding is not at present largely carried on in the district, but the resuscitation of some old firms in the district is likely to result in a considerable shipbuilding trade being developed. The demand for finished iron is very brisk, and the mills are all fully employed. The chief output consists of rivet iron, billets, puddled bars, &c. The tinplate works are fully employed, and a large number of orders are held by makers. Iron ore is not in as great demand as of late, and parcels of considerable size have changed hands at about 25s. per ton up to 30s., and this in face of the fact that raisers are largely sold forward. Coal and coke in steady local demand, but the Irish demand for fuel is inconsiderable.

CONTINENTAL MINING AND METALLURGY.

FRANCE.

IT is a little doubtful whether prices in the markets of France have not begun a retrograde movement. After standing still a week or two, they begin to be heard of as falling in various districts of France, the north and east more particularly, as well as in Belgium. In both countries the shrunken quotations are laid to the charge of speculators who, having bought low, are now compelled to realise, and, in order to do so, undersell makers, which they can very well afford to do. Their action would simply mean that, in their opinion, prices had now come to their apogee, and that they would be losing interest on their ventures by holding over any longer. Our contemporary, *L'Ancre*, examines the whole question at length, and makes a tolerably substantial defence of its position—that there is no present indication of any real decline, and that prices will be kept at their present level all the year through. It argues that the symptoms of decline have been intentionally exaggerated by buyers who have been shut out of the market by the late rapid rise in rates, and examines in detail the reasons adduced by them. These are, mainly, that America has ceased buying, that foreign markets are weak, that business has been lately done at falling rates, that make has increased. Hereto it is replied that the continuance of the American demand has never been built upon—its only function has been to start the revival, the course of which must be determined apart from the Transatlantic demand; that the apparent weakness in foreign markets is simply a recoil from the exaggerations of the earlier days of the revival, but that rates can afford to come down a few shillings after having gone up from £3 to £4. And as to France, its own internal demands are sufficient to guarantee rates from any serious decline, the rather as they have not been run up rashly. The falling rates quoted for late bargains have been already explained. As to an increase of make on a large scale it is not so easy to effect as might be supposed, when it has to start with an increase of cost for raw material. When make has been increased, it is mostly when long term contracts are in hand both for sale of make and supply of material. Many makers are so far sold forward that they are quite at their ease as to rates, and can afford to wait until the market has declared itself distinctly. "For these reasons, we conclude that the prices of metallurgical produce are firmly enough established to be capable yet of a long resistance. The turn of the reaction has not yet come. For a couple of months the market has gone forward at accelerated speed; its pace is now slackened; but prices are likely to find a fresh impulse in the putting in hand of private undertakings and the enlargement of public works." Pig is easier generally, both on account of importations, and because the furnaces can now get fuel without interruption. Coke is lower than it was during the famine; it can be had at 23s.; for forward deliveries, however, 24s. to 27s. is asked.

Light iron rails for branch lines of way, which are now being rapidly built in the north and east, are in brisk demand. They are currently quoted at £10 at the works. A lot of 500 tons of tram rails was, after some discussion, taken last week by a Valenciennes forge at £9 12s. Nominal rates at Paris are still 270 fr. (£10 16s.) for merchant irons, 280 fr. (£11 4s.) for beams, 310 to 320 fr. (£12 8s. to £12 16s.) for plates. Paris founders are very busy and are giving £5 per ton for old chairs. Importation warrants are at 18 fr. and 19 fr., the duty itself being only 20 fr. The Compagnie Auxiliaire has had the temerity, for which it has been properly scolded, to order wheels and axles in Belgium, on the unpatriotic pretext that the Belgian prices were lower than the French. The news that a lot of old rails, 5000 tons in weight, have been sent to America without finding a purchaser has had a depressing effect.

Haute-Marne is fortunate enough to be in daily receipt of orders up to a fourth or third of the current make, which, added to contracts in hand, keeps business extremely active. Art castings are rising. The Sommevoire Foundry has recently taken a heavy order for telegraph tubing at £7 10s. A couple of months ago offers for the same material on the footing of £7 were declined.

In the Nord it is under discussion to carry the standard syndicated rate from 240 fr. up to 250 fr. (£10). Durmont and Co., of Louvroil, are putting down plant for the manufacture of steel sheet.

Rail mills in the Loire and Rhône are profiting now by the operation of the law of natural selection, which during the past few years has been at work weeding out weak mills. Local competition is at an end, and good prices are got for rails as well as good business. The Eastern of France lately gave out 20,000 tons of steel rails, for which it has had to pay from 295 to 300 fr. (£11 16s. to £12). This is equal to about £11 4s. at the works, and even French mills make a profit at such a rate. The shipbuilding yards of the Messageries Maritimes, employing, when at full work, about 3500 hands, are again filling. The Government small arms factory is discharging workmen. The Micheville Ironworks Company, at Villerupt, has called a meeting of its shareholders for the 30th, to decide upon the erection of steel-works.

At the meeting on February 27th of the Paris Society for the Encouragement of Industry samples of pure nickel rom the workshops of Gaspard and Belle, of Paris, were exhibited. Nickel being inoxidisable in air, being almost as infusible as platinum, and more malleable and ductile than iron, and stronger than this latter metal in the proportion of 3 to 2, would seem to have a wide range of uses open to it. But as commonly prepared it contains impurities which render it brittle. A. M. Fleitmann, whose patents are in the hands of the firm above-mentioned, was led to believe that melted nickel absorbed carbonic-acid gas, and that therefore the addition to the bath of an easily oxidisable body would free the nickel from this impurity. On adding small quantities of magnesium it was found that the nickel left the crucible in as malleable a condition as could be desired. The samples shown were evidence of its malleability and ductility, and its property of welding. A sheet of iron being laid between two sheets of nickel, and the whole brought up to a red heat, can be rolled down to the tenth of a millimetre.

The Minister of Public Works, M. Varroy, has appointed a commission to inquire into the causes of the blockages at various goods stations in Paris during the winter, and to propose means of prevention of such interruptions to traffic. If this commission is to take the place of the big order for 2000 trucks which the Northern of France was said to be on the point of giving, its nomination will not be much relished.

The Compagnie Générale des Eaux, at Paris, will probably have to submit to a revision of its contract with the municipality. A commission of revision has drawn up a report suggesting that (1) the work of laying piping, &c., which is now done by the company and charged to the landlord at the prices current in 1860 (45 per cent. higher than those of 1880) shall be thrown open to public competition; (2) a high-pressure service to be established experimentally, at a minimum annual rent per tap of 18 fr. (14s. 2d.); (3) in other cases payment be made by meter measurement instead of by valuation, the company to lend out meters where desired, or to accept such types of meter as the municipality may determine.

BELGIUM.—A curious incident related by the Brussels *Intérêts* has shaken the Belgian market. Following on the Grivegnée reduction an agent of the Providence works sent out price lists revised in the sense of decline. His action was repudiated by his principals, but buyers are holding back, and on both sides the opening of April is looked forward to with some little anxiety. If a rise does not occur a fall is inevitable, and it may then be rapid. The standard price for iron has gone back at Liége to £8, and at Charleroi to £7 12s. Angles are held in the latter district at £8 8s.; beams, at £8 to £8 8s.; plates, at £11 4s. The inquiry for beams at Charleroi is said to be stronger now than it has been for many seasons, and any fall in rates to be very improbable. The Government has sadly disappointed expectation in the matter of the 100 locomotives which it had to give out by despatching an agent to Roumania for the negotiation of sixty-four second-hand engines, which, added to the forty already distributed amongst certain Belgian makers would meet all the requirements of the Government. The latter is getting pinched for money, and will not, it is thought, appear again this year in the market.

The shareholders of the Midi de Charleroi, who are owners of furnaces which it cost £70,000 to build, and of a stock of ironstone worth £12,000, are making another effort to raise £4000, and start the works again. If this effort fails, the works are to be sold by auction. The Jupille mills are for sale on the 30th. The Zône mills were adjudged on the 26th ult. to M. Closson, of Liége, for £8400, ratification to follows. The Steinhauser Bessemer plant, at Witten, the sale of which we mentioned in our last, has been bought by the Angleur Steelworks. These works will thus add a pair of converters to their present plant, and increase their make from 100 tons a day to 300 or 350 tons. The amount paid for the new plant is supposed to be under £14,000. It will be ready for work in its new home in about four months, and will, says the *Intérêts*, enable the Angleur works to meet the increasing demand for Thomas dephosphorised metal. In reference to the spread of the dephosphorisation process, the *Journal de Liége* says:—"We hear of the erection of important steelworks on our frontiers, in which it is intended to work by this process. Independently of the five or six firms in Alsace-Lorraine and Luxembourg, the inventors have been in negotiation with the Longwy syndicate, which proposes to construct important works. There is thus a speck on our industrial horizon of menace to our ironworks as well as our steelworks. Dephosphorised steel is highly malleable, and seems destined to become a serious competitor for certain products of the puddling furnace."

The commune of East Flanders has been allowed to tax steam-boilers and steam and other engines. At Ghent, boilers are to pay 2s. per square metre of heating surface, and gas-engines 2s. 6d. per h.p. At Termonde, steam-engines pay the same; gas-engines, 3s. 4d. per h.p.; and boilers, 2s. 6d. per square metre of heating surface.

GERMANY.—The following comparison of prices is between those of Dortmund on Feb. 16 and those of Düsseldorf on March 8:—

	Dortmund. Feb. 16.	Düsseldorf. March 8.
German foundry pig ..	£5 15	£5 5
,, Bessemer pig ..	6 10	5 15
Common bars	11 5	10 10
Boiler-plates	15 0	13 15

English Bessemer pig is on a level at Düsseldorf with German. The figures above given would indicate a certain weakening of prices all round, but we are constantly assured that most of the western furnaces and mills are full for the year, and that the long-term contracts which have been placed are a sufficient proof of the general confidence in the continuance of the revival. The Bochumer Verein, for instance, has contracts on hand for coking coal which will take eighteen months to run out. The prices got are good, and 500 fresh hands have been taken on at the Verein's collieries. It is by some thought that the demand for pig will not be overtaken very rapidly by the efforts now making to increase production. A year or two ago the mills had large quantities of old rails at their disposal, and worked up perhaps one-fourth scrap to three-fourths pig. As all the scrap available has been bought up and sent out of the country, its place will have to be supplied by new-made raw material. Then, in presence, in the early part of last year, of the strong importations of foreign pig, native makers relaxed operations, and the main stock of pig with which the revival was begun consisted of imported material. This has been worked down, and so a vacuum created which imported pig cannot fill, owing to the obstruction caused by the import duties. Hence, it is argued, German makers may look forward to a comparatively long period of unchecked prosperity.

In Berlin, as in Brussels and Paris, merchants' quotations are in some cases lower than makers'. If the makers do no come down to the merchants, it is certain that the merchants will have to go up to the makers. At present it is not clear who will take the first step, and there is naturally some uncertainty in the market.

The effect of the Thomas-Gilchrist process on the manufacture of machinery is thus set out in the last business report issued by the Wetter Machinery Works, Wetter a.d. Ruhr:—"The invention lately introduced for converting phosphoriferous pig into steels and irons of high quality are of great importance to our business (as manufacturers of machinery). Now that German intelligence has succeeded in perfecting (*vervollkommnen*) the process invented in England, a question of the highest importance for the iron trade has been definitively settled, and that settlement will have for effect the founding of many new undertakings. We have ourselves, as a matter of fact, received since the beginning of the year several large orders based upon the use of Thomas metal, and we have every reason to expect that very considerable orders will shortly follow upon those already in hand."

Among the prizes offered by the Prussian Society of Arts is one of £50 for the best essay on improvements in the manufacture of iron wire during the last ten years; and one of similar amount for the best essay on driving bands.

Mr. W. Bersch, of Berlin, reports in the last published *Zeitschrift d. V. deutscher Ingenieure*, on the methods of enamelling cast-iron goods practised in Lower Silesia.

AUSTRIA.—There is great firmness in the market of Austria, works there being secured, as is the custom when there is business in this market, many months ahead. Merchant irons are in good demand, building requirements are above the average, and the rail mills have good contracts on hand. Since the beginning of the revival prices for pig have gone up by 50 per cent., and merchant irons by 30 per cent. On the 24th ult. the Northern of Hungary let tenders for 5400 tons of steel rails (delivery within three years) in equal shares to the Witkowitz and Staatsbahn works, the former taking a ton of old rails and 82.5 fl. cash, and the latter 123.5 fl. cash. The Austrains have lost 10,000 tons of rails for the South Italian Railways to Bolckow-Vaughans, at £10 per ton delivered at Naples. The rails were wanted of a heavy profile 12 metres long; the only Austrian tender sent in was for 9 metres rails, and this was rejected. There is a lot of 8000 tons of rails for the Alta Italia now in course of negociation. The Putilow Bessemer works, near St. Petersburg, have placed an order for several hundreds of tons of Bessemer pig with an Austrian furnace. The Prague Ironworks Company, which has been experimenting in dephosphorisation, has been so successful in its experiments that it has determined to introduce the new system into its current operations. Hitherto Bohemian forgemasters have been compelled to import high-class pig from Styria or Germany, and the rise in price of raw material had therefore made itself keenly felt. The adoption of the new system enables the Prague Ironworks to use up its own make, and to discontinue its purchases of foreign material. Heavy contracts are on hand for ferro-manganese and speigeleisen both on home and foreign accounts, occasioned in part by the spread of the Thomas-Gilchrist process. The exports of old rails and pig to America have been so brisk as to have sent up freight from 4s. in November to 20s. in February. Large quantities of scrap have been taken by Germany as well; and at the end of February, the average of prices in Austria was lower than in Germany and England. Pig will possibly continue to rise. Machinery works, especially those of Bohemia, are well found in orders, sugar machinery for Russia forming a sensible proportion of them. Locomotive factories have good hopes of work on Italian and other foreign accounts.

RUSSIA.—The *Moniteur des consulats* calls attention again to the deposits of ironstone in the interior of Russia. "In no country has iron more value than in Russia, and its wants are such that iron must keep up its price there. When in the States of Western Europe scarcely £6 per ton could be got for iron and £12 for steel, Russian consumers were paying £16 for iron and up to £40 for steel of similar quality. In spite of these prices, foreign producers do not always sell at a very large profit, the deductions on account of duty, carriage and commission being very heavy. It must, therefore, be inevitable that before long a beginning will be made on a large scale to cover home requirements by home production, and investigations and surveys are now being conducted for the purpose of ascertaining the possibility of building blast-furnaces in proximity to the deposits of ironstone. The immense extent of the country is in itself a guarantee for railway construction on a large scale; then there is the development of building, and the normal increase in trades due to the growing wants of an improving civilisation. There is still plenty of wood to be had for smelting; but in Southern Russia there are also inexhaustible deposits of coal, and even paying £2 per ton for coke, the manufacture of iron would give enormous profits. Russian ores are so easily treated that iron could be made for £6 per ton, and instead of incurring heavy charges for carriage it would pay better to set up works at a sufficient distance from each other to fill up the area between them. Besides, the direct and indirect support given by the Russian Government to the home iron trade is so considerable that works set up on a sufficiently large scale could not fail to prosper. With small works the general expenses would be too heavy for the capital. In the province of Orel, not far from Moscow, are mines of ironstone of very superior quality, fit for the manufacture of the highest class of goods. With a simple screening they give 90 to 95 parts in the hundred of metal, with 2 to 3 per cent. manganese. Some three years ago the working of these ores was begun on a small scale, and analyses made in Paris of the products justified all expectations concerning them. To set up furnaces and ironworks in their vicinity would be to take the high road to fortune."

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1007 to No. 1118, being the entries from March 9th, to March 15th.

NEW APPLICATIONS.

Acoustic Apparatus.—A communication.—*F. Wirth, Frankfort-on-the-Main, Germany.* [1014
Air in Gaseous Mixtures.—A communication.—*W. P. Thompson, London.* [1101
Air to Furnaces.—*T. S. Prideaux, Brockley, Kent.* [1053
Ammonia Manufacture.—A communication.—*J. H. Johnson, London.* [1086
Apparatus for Turning Leaves of Music Books.—A communication.—*C. D. Abel, London.* [1106
Axle Arms, &c., of Carriages.—*J. Offord, London.* [1071
Bankers' Cheques.—*T. H. Case, Plumpton, Sussex.* [1118
Basic Bricks.—A communication.—*P. M. Justice, London.* [1018
Bearings for Shafts and Axles.—A communication.—*P. H. F. Engel, Hamburg, Germany.* [1066
Bicycles.—*T. D. T. Sparrow, London.* [1070
Bicycles.—*A. Jennings, Glasgow.* [1072
Boat Lowering Apparatus.—*E. Bond, London.* [1073
Boot, &c., Fasteners.—*M. L. Müller and H. Hartjen, London.* [1031
Bottle-Filling Apparatus.—*J. McEwen and S. Spencer, Manchester.* [1076
Braiding Machine Spindles.—*J. Booth, Manchester.* [1061
Braids.—*F. E. A. Busche, Schwelm, Westphalia.* [1115
Carburetting Air.—A communication.—*E. Edmonds, Fleet Street, London.* [1034
Carriage Springs.—*W. Fleet, Balsall Heath, Worcestershire.* [1017
Chimney Cowls and Ventilators.—*A. Hancock and H. S. Heath, London.* [1096
Cigarettes.—A communication.—*R. Gottheil, Berlin.* [1057
Circular Saw Benches.—*B. J. Webber, Newton Abbot, Devonshire.* [1030
Coal-Cutting Machines.—A communication.—*W. R. Lake, London.* [1025
Coil Springs for Mattresses.—*H. Smith, Dublin.* [1036
Coke Ovens.—*W. O. Wood, Coxhoe, Durham.* [1094
Concrete for Building.—*C. Drake London.* [1044
Controlling Engines.—*R. H. N. Alleyne, Alfreton, Derbyshire.* [1023
Compressed Air Motor.—*V. Poulet and E. Commelin, Hautmont, France.* [1046
Crucibles, Retorts, &c.—A communication.—*W. R. Lake, London.* [1028
Cylinder, &c., Drawing Machinery.—*G. Little, Oldham.* [1082
Ecraseurs.—*W. H. Beach, London.* [1084
Expansion Valves.—*J. Ramsbottom, Alderley Edge, Cheshire.* [1060
Extinguishing Fires.—*S. R. Edwards, Redruth, Cornwall.* [1113
Feeding Horses.—*F. H. Greenstreet, London.* [1016
Feed-Water Heaters, &c.—*H. W. Cook, Stondon Masser, Essex.* [1009
Feed-Water Injectors.—*G. W. Garrett, Manchester.* [1041
Filtering Liquids.—*R. Schomburg, South Norwood.* [1068
Fireproofing, &c., Buildings.—*T. Hyatt, London.* [1104
Fluid Pressure Regulator.—*C. C. Barton, Rochester, New York, U.S.A.* [1040
Fog Signalling on Railways.—*S. A. Say, London.* [1114
Furnaces.—*J. R. Pickard, Leeds.* [1020
Galvanising Metals.—*J. E. Reynolds, M.D., Dublin.* [1112
Gas Regulator.—*J. McLennan and R. Owen, London.* [1055
Gas Regulators.—*F. Wright, London.* [1092
Gas Stoves.—A communication.—*F. C. Glaser, Berlin.* [1063
Glove Springs.—*J. Hincks and T. Hooper, Birmingham.* [1087
Goods Boxes.—A communication.—*G. Davies, Manchester.* [1075
Hand Signal Lamps.—*H. Defries, London.* [1080
Heating and Illuminating Gases.—*J. A. Stephen, Worcester, Worcestershire.* [1038
Horse Shoes, &c.—*J. Holt, J. Maude and B. Jones, Bolton-le-Moors, Lancashire.* [1030
Hydrocarbon Lamps.—*A. E. Ragg, Bebington, Cheshire.* [1007
Ice-making, &c.—*B. L. Beckwith and T. B. Lightfoot, Dartford, Kent.* [1110
Iron and Steel Furnaces.—*S. Thomas and D. Thomas, Trowell, Nottinghamshire.* [1012
Iron Roofing for Buildings.—*L. Gilquart, La Buissiere, Belgium.* [1065
Jointing and Laying Pipes.—*H. F. Stanley, London.* [1108
Knitted or Looped Fabrics.—*S. Thacker, Nottingham.* [1032
Leather and Artificial Leather.—*R. Brown, Ayr.* [1090
Linoleum, &c.—*C. F. Leake, Staines.* [1111
Liquid Measures.—*D. Moulton, Birmingham.* [1037
Locomotive Engines.—*C. Brown, London.* [1052
Long-Napped Cloth.—A communication.—*A. C. Henderson, London.* [1047
Looms.—*J. Garstang, Burnley, Lancashire.* [1103
Looms.—*G. F. Dawson, J. Meyers and J. Smith, Bradford.* [1105
Machine Tools and Tool Holders.—*J. Angus, London.* [1001
Magnesia.—*T. Twynam, North Kensington, London.* [1019
Mangling Machines.—*J. Wilding, Poulton-le-Fylde, Lancashire.* [1059
Needle-Threading Apparatus.—*J. Darling, Glasgow.* [1109
Oil Lamps.—A communication.—*J. F. Hayne, London.* [1102
Ornamenting Pottery.—*T. Bevington, Hanley, Staffordshire.* [1043
Pantaloon Suspenders.—A communication.—*H. J. Haddan, London.* [1015
Photo-Chemical Printing.—*W. Willis, jun., Bromley, Kent.* [1117
Photograph Holders.—*J. M. Rogers, London.* [1093
Photography.—*J. and W. I. Chadwick, Manchester.* [1054
Plaiting Machinery.—*N. Wilson, London.* [1027
Postal Letter Boxes.—*J. B. Cull and J. B. Fenby, Sutton Coldfield, Warwickshire.* [1010
Printing, &c., of Cotton Fabrics.—*J. King, Glasgow.* [1062
Printing Floorcloths.—*A. L. Klein, Lancaster.* [1098
Pulleys.—*E. C. F. Otto, Peckham.* [1011
Pulverising Machinery.—*A. C. G. Thompson, Chiswick.* [1033
Railway and other Brakes.—*C. Groombridge, London.* [1049
Railway Signals.—*G. Edwards, Cheltenham.* [1079
Range Finders.—A communication.—*T. Morgan, London.* [1095
Recovering Soda Ash from Waste Liquors.—*A. Chapman, Liverpool.* [1078
Releasing Horses for Carriages.—*C. Woolnough, Eaton Square, London.* [1021
Repulping Paper.—A communication.—*A. M. Clark, Chancery Lane, London.* [1050
Rimers.—*A. Coventry, Salford, Lancashire.* [1085
Rolling Machinery.—*G. Colton and C. H. Smith, Ince, Lancashire.* [1029
Saving Life from Fire.—A communication.—*H. J. Allison, London.* [1024
Scrubbing Brooms.—A communication.—*P. Jensen, Chancery Lane, London.* [1107
Securing Box Bottoms.—A communication.—*W. F. Lotz, London.* [1008
Sewing Machines.—A communication.—*E. P. Alexander, London.* [1116
Shaving Bracket.—*J. H. R. Triscott, Plymouth.* [1035
Ship Propeller.—*J. McLennan and R. Owen, London.* [1056
Spectacles.—*S. Offenbacher, London.* [1064
Spinning Apparatus.—*J. Pollard, Haworth, Yorkshire.* [1022
Steam Generator.—A communication.—*F. J. Brougham, Westminster, London.* [1067
Stiffening and Waterproof Liquor.—*J. Swallow, Leeds.* [1045
Substitutes for Leather, &c.—*T. L. Alemand, Paris.* [1077
Sugar-making.—*F. G. Harvey, Hillside, Vere, Jamaica.* [1088
Tables.—*H. Halstead, Leeds.* [1048
Taps.—A communication.—*R. Schomburg, South Norwood.* [1083
Telephonic Apparatus.—*F. H. W. Higgins, London.* [1081
Treatment of Nickel and Cobalt.—*H. Wiggin, H. A. Wiggin, A. S. Johnstone and W. W. Wiggin, Birmingham.* [1058
Treatment of Ores.—*F. M. Lyte, London.* [1051
Tricycles.—*A. T. Burton, Cambridge.* [1069

Umbrellas.—*S. Kolt, Salford, Lancashire.* [1009
Utilising Refuse.—*J. Wadsworth, Manchester.* [1032
Ventilators.—*C. T. Marzetti, London.* [1026
Washing Machines.—A communication.—*W. R. Lake, London.* [1009
Washing Machines.—*W. T. Brown, Bootle, Lancashire.* [1089
Water Engines.—*E. Wignell and J. Pollit, Sowerby Bridge, Yorkshire.* [1013
Weaving Loongees.—*C. Cross, Manchester.* [1027
Weighing and Measuring Apparatus.—*M. B. Tetley, Dunmow, Essex.* [1007

COMMERCIAL.

TRADE AND TAXATION.

THE gross amount of profits of trades and professions, public companies, railways, gasworks, &c., assessed under schedule D for 1877-8, for the United Kingdom, was £260,626,971; and this was an increase on the preceding year of £3,718,228. The report of the Commissioners of Inland Revenue, just issued, tells us that the principal improvements in the assessments are found in the counties of Essex, Southampton (it is so printed, but Hampshire is probably meant), Norfolk, Stafford, Sussex, Kent, Surrey and Middlesex. The decreases were mainly attributed to the depression in the mining and iron trades, and they were as follows:—York, £454,000; Durham, £331,000; Lancaster, £190,000; Northumberland, £137,000; Carmarthen, £56,000; and Cornwall, £43,000. The percentages of increase in England were as follows:—Trades and professions, 1·97; quarries, 22·15; gasworks, 15·03; waterworks, 7·93; railways in the United Kingdom, 1·64; railways outside, 34·29; interest paid out of rates, 5·18. The principal decreases were under the following heads:—

	Increase.	Per cent.
Mines ..	£1,094,000	8·60
Ironworks ..	321,000	14·81
Public companies	454,000	2·17
Other profits	207,000	25·46

In Scotland the increases were as follows:—Trades and professions, 4·88 per cent.; quarries, 20·27; gasworks, 7·60; canals, &c., 8·54; public companies, 12·38; and railways, 0·79. There were the following decreases in Scotland:—

	Increase	Per cent.
Mines	£101,000	7·46
Ironworks ..	159,000	25·32
Other profits ..	69,000	19·27

The principal decreases in England occurred in 22 districts, of which three embrace the City, two Manchester and one Birmingham. There remain sixteen districts in which the decreases are more or less attributed to mines or ironworks. The names and figures are as follows:—

	Net assessments. 1878-9.	Decreases.	Decreases under Mines.	Decreases under Iron-works.
Blackburn ..	£1,232,160	£237,158	33,835	
Bolton ..	1,662,765	257,923	38,424	7,330
Bradford ..	2,393,774	248,720	11,219	37,204
Cardiff ..	1,899,044	304,284	242,042	8,082
Darlington ..	1,271,089	180,503	128,566	14,199
Halifax ..	1,213,536	163,608	7,870	
Leeds 1st ..	2,386,961	217,925	200	10,020
Newcastle 1st	2,295,423	123,505	84,067	
Newcastle 2nd	1,617,796	270,191	169,489	
Oldham ..	1,140,224	277,772	3,353	
Warrington	1,785,194	265,909	224,102	
Whitehaven	1,080,092	223,846	165,978	9,048
Wakefield ..	1,325,573	99,559	106,050	
Lancaster ..	1,425,137	Incre. 41,614	—	38,772
Stockton-on-Tees	1,279,166	187,444	18,080	44,214
Wolverhampton	1,465,314	180,771	65,232	25,169
			1,298,507	194,038

The total decreases in the 22 districts, including the City, Manchester and Birmingham, amount to £4,300,769, on net assessments of £57,372,145. The total decrease on the net assessments under schedule D for 1878-9 was £5,037,000, and the Commissioners say it is not possible to find a parallel to that without going back for 30 years, viz., to 1848-9, before the extension of the tax to Ireland, when the decrease under schedule D on Great Britain amounted to £5,530,000. How much of the decrease of 1878 is due to the concession made under the Act of that year of an allowance for depreciation and wear and tear of machinery or plant cannot be stated, but the concession may have swollen the diminution arising from the general depression of trade in the districts named in the foregoing table.

While the assessments on mines and ironworks fell off, those on lands and tenements stood still; but the Commissioners, in their report, anticipate, and are probably now realising, a considerable decrease, which will seriously affect the furnaces of the present year. The gross annual value of lands, £69,324,989, is 113,643 less than in the preceding year. The Commissioners say the decreases are small, are generally distributed, and are not due to diminished valuations, but are accounted for by corrections of assessments. The depression had not reached the land for the year reported upon; but, looking forward, the Commissioners see that 1879-80 will be affected. They say that the prevailing agricultural depression has led, in many cases, to farms, which had recently fallen into the hands of the proprietors, being relet at reduced rents, and, when this is the case, or when rents reserved under existing tenancies may have been reduced by a fresh agreement for a definite period of three years, corresponding with the period for which the new Income Tax Assessment will, according to precedent, be continued, there will be a corresponding reduction in the value assessed under schedule A for 1879-80. A similar result was caused by the agricultural distress which prevailed when a new assessment was made for Income Tax in 1851-2, and the annual value of lands assessed in Great Britain for that year showed a diminution of £1,377,000 as compared with the preceding year.

The amounts of duty charged were £5,891,829 in 1877 and £5,940,739 in 1878. The details for every place in the country for 1878 have just been issued as a separate parliamentary paper, which can be had for a few pence.

JAMES H. WEAGER AND CO.'S METAL REPORT.

BUSINESS has been rather restricted the last week, and prices for most descriptions have ruled flatter. This aspect of affairs has come with some surprise, the general opinion having been, and still obtains, that the improvement in metals will be permanent, although fluctuations doubtless will take place; nevertheless, it was hardly anticipated that values would recede quite as rapidly as they have done in some metals. Iron: The Scotch market for pigs has not shown much spirit since our last. Warrants have receded some 5s. and close flat. Middlesborough market also dull. Staffordshire iron not quite so active, although makers are pretty well booked. Copper dull, and about £1 lower all round. We attach prices below. Tin: Contrary to expectations, this metal has sustained a further fall, and closes, for Straits and Australian, £88 5s. The Dutch Trading Company's sale takes place on the 31st inst., when 15,000 slabs Banca, and 5200 slabs Billiton will be offered. English tin seems loath to follow foreign, and it is still well maintained in some quarters that the fall is but temporary, and we are inclined to endorse this view. Lead: Certainly easier. Middle parcels have unquestionably precipitated a downfall, although better prices shortly are looked for, and consumers could pretty safely and profitably, we think, examine their stocks. Tinplates are dull; makers well employed, and adhering to advanced rates, but cokes can be bought at 27s. London. Our present prices for metals are:—Iron, bars, Staffordshire: £8 10s. to £9 per ton; hoops, £9 10s. to £10; sheets, £10 19s. to £11 per ton. Copper, Chili slabs for 96 per cent: £66 10s. per ton; English ingots and blocks, £74 to £76; sheets, sheathing and rods, £79 to £80; yellow metal sheets and sheathing, £6 10s. per ton. Tin, English ingots and blocks: £93 per ton; bars, 4 cwt. barrels, £94; foreign, Straits, £88 5s.; Australian, £88 5s. per ton. Tinplates, cokes: 27s. to 28s. per box; charcoals, 29s. to 31s. Lead, Spanish pig: £17 per ton; English, £17 10s.; bars, £18; pipe, £18 10s. per ton. Zinc: £23 10s. per ton. Antimony, £72. Quicksilver, £7.—26, Leadenhall Street, E.C.

SOUTH WALES COAL SHIPMENTS, FEBRUARY, 1880.

SUMMARY of foreign coal shipments from Cardiff, Newport, Swansea and Llanelly, during the month of February, 1880:—

	Tons.		Tons.
Aden	15,026	Java	850
Africa, W.C. ..	323	La Rochelle	9,742
Alexandria	5,818	Leghorn	1,067
Algiers	617	Lisbon	10,380
Alicante	1,592	Madeira	1,593
Amsterdam	1,441	Malta	22,349
Anjer	1,450	Maranham	397
Bahia	2,515	Marseilles	3,638
Barbadoes	432	Martinique	2,063
Barcelona	17,211	Messina	405
Bayonne	238	Monte Video ..	6,926
Bergen	846	Nantes	2,014
Bilbao	3,278	Naples	3,934
Bombay	12,634	Odessa	7,351
Bordeaux	9,878	Oporto	765
Boulogne	509	Palermo	17,940
Brest	814	Palma	1,326
Brindisi	6,786	Pernambuco ..	1,397
Buenos Ayres ..	1,584	Piræus	1,777
Cadiz	10,290	Port Said	32,877
Caen	6,631	Rangoon	1,902
Calcutta	3,127	Rio de Janeiro ..	9,253
Callao	1,249	Rio Grande do Sul ..	315
Cape de Verds ..	5,754	Rochfort	6,053
Cape Town	8,757	Rouen	16,245
Carlo Forte	1,080	Salonica	460
Carthagena	800	Santiago	1,291
Ceylon	3,179	Santos	2,691
Charente	1,136	Savona	5,470
Constantinople ..	8,130	Seville	1,162
Copenhagen	1,597	Singapore	11,602
Coquimbo	2,910	Smyrna	1,589
Corfu	1,430	St. Lucia	1,114
Dara	1,782	St. Malo	6,765
Dieppe	26,574	St. Nazaire	27,126
Fayal	370	St. Thomas	2,788
Fecamp	1,896	Sulina	1,486
Genoa	20,747	Syra	1,334
Gibraltar	16,795	Tarragona	554
Guadaloupe	1,655	Trieste	3,571
Hamburg	1,170	Trouville	3,569
Havannah	9,691	Valencia	767
Havre	27,008	Valparaiso	1,735
Hong Kong	10,024	Venice	1,522
Jamaica	1,165	Vigo	1,430

NEW COMPANIES.

A. S. SHAW AND COMPANY.—This company proposes to take over the business of coal, lime and mineral merchant carried on by Austin Stable Shaw at Halifax. It was registered 6th inst, with a capital of £6000 in £1 shares.

FOWLER AND MCCOLLIN.—With a capital of £50,000 in £10 shares, this company proposes to purchase and continue the business of general engineers, iron and brass founders, boiler makers, &c., carried on by the above firm at the Vulcan Iron Works, Scott Street, Swann Street, York Street, and Albert Dock, Kingston-upon-Hull. It was registered 8th inst.

F. N. SEYDE AND COMPANY.—This company was registered 9th inst., with a capital of £6000 in £25 shares, to purchase under an agreement of 17th of January (unregistered) the business of varnish manufacturer, carried on by Francis Napier Seyde, of Bilston.

GIFFARD REFRIGERATION.—This company was registered 9th inst., with a capital of £10 000 in £50 shares, to acquire and work all or any of the following letters patent, viz.:—No. 55, dated 6th January, 1875, granted to Alexander Dick for "An improved compressed air or gas spring, and stuffing box to be used therewith. No. 1889, dated 22nd May, 1875, granted to Alexander Melville Clark for "Improvements in piston packings." No. 2069, dated 4th June, 1875, granted to A. M. Clarke for "Improved machinery for the artificial production of cold for ice-making and other purposes." No. 3108, dated 15th of August, 1877, granted to Paul Giffard for machinery and apparatus for the artificial production of cold, and also Indian letters patent in respect of the same.

GOLD COAST MINING.—On the 9th inst. this company was registered with a capital of £65,000 in £1 shares, to acquire the mineral property known as "Abboutuyakoon," in the Wassau District, near the Port of Axim, on the West Coast of Africa.

HOOTON MANURE.—This is the conversion to a company of the business of manufacturer of artificial manure carried on by Mr. William Webb at Hooton, Chester. It was registered 3rd inst., with a capital of £5000 in £5 shares.

NEW GROSVENOR COLLIERY.—This company was registered 3rd inst., with a capital of £5000 in £10 shares, to acquire and work certain leasehold hereditaments and coal and ironstone mines situate in the townships of Coed Poeth, in the county of Denbigh.

PENPOLL TIN SMELTING.—For carrying on, in all branches, the business of smelting, this company was registered on the 5th inst., with a capital of £10,000 in £10 shares.

PURTON GAS.—Registered 6th inst., with a capital of £2000 in £5 shares, to erect gasworks at Purton, Wilts, according to the specifications and plans of Mr. William Cartwright Holmes.

SILICA COMPANY.—This company proposes to purchase the Horse Grove Estate, parish of Rotherfield, Sussex, containing deposits of silica. It was registered 5th inst., with a capital of £500 in £1 shares; £10,000 is to be raised in debentures, bearing 5 per cent. interest, and £5000 in debentures bearing 7 per cent. interest, the first-mentioned having priority over the second. 400 shares, to be termed A share, are to be allotted amongst the holders of the first mortgage debentures, and the remainder amongst the holders of the second mortgage debentures.

SILVERLODE LEAD MINING.—This company was registered 6th inst. with a capital of £40,000 in £2 shares, to acquire and work mineral lands situated at Shallee in the county of Tipperary, Ireland.

SOLID NUT.—Upon terms of an agreement of 20th ult., this company proposes to purchase the interest of Mr. John Walker Newall, of Salford, in the letters patent No. 101(80), dated 9th of January, 1880, and granted for improvements in the construction of apparatus for cutting bars or tubes of metal. The company further proposes to carry on the business of nut and bolt makers, engineers, millwrights, machinists, iron and brass founders and ironmasters. It was registered 3rd inst. with a capital of £20,000 in £100 shares. The purchase consideration is £2,000 in fully paid-up shares.

TYNESIDE MUTUAL SHIP INSURANCE ASSOCIATION.—Registered 4th inst. as an unlimited company without capital, for the mutual insurance of members interests' in ships.

UPPER WIDNES CHEMICAL.—Registered on the 3rd inst., with a capital of £50,000 in £10 shares, to carry on the business of chemical manufacturers, and brick and tile makers.

IMPORTS OF METALS AND ORE

FOR the month of February, 1880, as compared with the corresponding months of 1879. Also the imports for the two months of 1880 as compared with 1879.

ARTICLES.	QUANTITIES. Feb., 1879.	Feb., 1880.	2 Mnths., 1879.	2 Mnths., 1880.
Copper:—Ore—	Tons.	Tons.	Tons.	Tons.
From Chili	55	—	59	—
C. of Good Hope...	1,610	1,753	2,455	2,383
Brit. N. America...	250	—	2,950	1,706
Other countries ...	5,165	8,090	8,023	13,269
Total ...	6,480	9,843	13,487	17,358
Regulus (incl. Precipitate) From Portugal ...	100	216	540	666
Spain	1,505	996	3,255	2,969
Chili	590	1,457	1,708	1,457
Other countries ...	503	855	674	1,147
Total ...	2,820	3,524	6,177	6,239
Unwrought or part wrought From Chili	1,492	2,220	5,574	3,178
Australia ...	1,143	1,135	1,915	1,305
Other countries ...	134	110	293	423
Total ...	2,769	3,465	7,782	4,906
Iron and Steel— Iron: Ore	87,158	151,042	168,513	334,109
Bar	885	5,573	4,281	15,081
	cwt.	cwt.	cwt.	cwt.
Manufactures ...	140,371	269,393	269,433	540,164
	tons.	tons.	tons.	tons.
Steel: Unwrought ...	153	513	294	1,115
Lead, pig and sheet ...	8,306	9,126	15,352	14,954
Pyrites of Iron or Copper, or Sulphur ore	42,757	51,197	85,326	102,685
	lb.	lb.	lb.	lb.
Quicksilver	614,925	1,228,395	1,238,569	1,731,332
	cwt.	cwt.	cwt.	cwt.
Tin, in blocks, ingots, bars, or slabs, and regulus ...	19,555	46,033	55,134	84,244
	tons.	tons.	tons	tons.
Zinc, crude, in cakes ...	1,264	3,054	3,066	5,477
	cwt.	cwt.	cwt.	cwt.
Manufactures of, unenumerated	16,272	29,858	29,311	73,209

ARTICLES.	VALUE. Feb., 1879.	Feb., 1880.	2 Mnths., 1879.	2 Mnths., 188 .
Copper:—Ore—	£.	£.	£.	£.
From Chili	1,370	—	1,430	—
C. of Good Hope...	17,170	43,825	41,507	58,315
Brit. N. America...	1,275	—	12,575	6,848
Other Countries...	48,377	75,595	85,092	121,535
Total ...	68,192	119,420	140,604	186,698
Regulus (incl. Precipitate From Portugal ...	4,020	8,610	19,100	26,415
Spain	51,205	39,443	116,293	127,087
Chili	14,660	48,502	45,235	48,502
Other Countries...	17,395	78,711	20,855	35,085
Total ...	87,260	175,293	201,595	237,683
Unwrought or part wrought From Chili	85,615	160,580	322,071	226,981
Australia ...	73,153	90,341	124,077	102,687
Other Countries...	8,428	8,127	17,932	33,387
Total ...	167,496	259,048	464,080	363,055
Iron and Steel— Iron: Ore ...	93,562	165,405	178,961	361,219
Bar ...	4,769	54,508	33,374	133,889
Manufactures ...	111,142	199,814	222,253	392,849
Steel: Unwrought ...	2,118	6,978	4,252	12,818
Lead, pig and sheet ...	122,021	174,209	247,335	281,480
Pyrites of Iron or Copper, or Sulphur ore... ...	97,237	116,683	194,565	225,707
Quicksilver	51,294	118,388	103,661	165,038
Tin, in blocks, ingots, bars, or slabs, and regulus ...	91,386	218,759	173,983	399,866
Zinc, crude, in cakes ...	20,783	61,715	51,195	108,436
Manufactures of, unenumerated ...	17,889	35,030	33,148	89,605

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

(Metal Market, City, Thursday Afternoon, 4 P.M.,

(*March* 18, 1880.)

METALS AND ORES.

	March 11.		March 18.	
	£ s.	£ s.	£ s.	£ s.
Copper (per ton)—				
Chili, for 96 per cent.	68 15/	68 15/	66 10/	—
Wallaroo	81 0/	—	80 0/	81 0/
Burra Burra	80 0/	80 10/	80 0/	—
English Tough	75 0/	—	74 0/	76 0/
English Ingot best	77 0/	—	76 0/	77 0/
Sheets sheathing and rod	83 0/	81 0/	70 0/	81 0/
Bottoms	85 0/	—	84 0/	—
Ore per unit	0 14/	0 14 6	0 14/	0 14 6
Phosphor Bronze				
Special Bearing Metal (p tn)	116 0/	—	116 0/	—
Other alloys (per ton	123 0/	139 0/	123 0/	139 0/
Tin (per ton)—				
Straits (Cash)	90 0/	—	88 5/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	94 0/	96 0/	93 0/	94 0/
Do. Bars	95 0/	97 0/	94 0/	95 0/
Do. Refined	97 0/	—	96 0/	—
Australian	90 0/	—	88 5/	—
Tin Plates, per box, I.C. coke f.o.b. London	0 27/	0 30/	0 27/	0 30/
IX. do.	0 32/	0 35/	0 32/	0 35/
I.C. charcoal	0 30/	0 36/	0 30/	0 30/
I.X ,,	0 36/	0 40/	0 36/	0 40/
Lead (per ton)—				
Soft English pig	18 7/6	19 0/	17 10/	—
Do. W.B.	—	—	—	—
Spanish soft	18 0/	—	17 0/	—
Do. with silver	—	—	—	—
Sheet milled	19 5/	—	18 0/	—
Red lead	20 10/	—	17 10/	—
White	24 0/	—	22 0/	—
Patent shot	21 10/	—	20 10/	—
Zinc (per ton)—from No. 9 Gauge.				
Sheets, rolled	24 0/	—	23 10/	—
Do., foreign	25 0/	—	24 0/	—
Spelter (per ton)—				
Silesian, com	21 0/	21 5/	20 15/	—
Rhenish	—	—	—	—
English	—	—	—	—
Quicksilver, bot.	7 0/	—	7 0/	—
Antimony ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—		—	—
French Star	71 0/	72 0/	72 0/	—
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 3/	—	0 3/	—
Brass (per lb.)—				
Sheets, 48×24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8½	—	0 0/8½	—
Yellow metal	0 0/6½	—	0 0/6½	—
Asbestos (per lb.)	0 0/3	0 0 6¾	0 0/3	0 0 6¾
Plumbago (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10 6	—	0 10 6	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	March 11.		March 18.	
	£ s.	£ s.	£ s.	£ s.
Iron, per ton (at works)*—				
Bars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common	8 0/	—	8 0/	—
Do. Best	8 10/	9 0/	8 10/	9 0/
Sheets, singles, Cleveland	10 5/	10 10/	10 5/	10 10/
Staffordshire	11 0/	11 10/	11 0/	11 10/
Do. doubles, Staffordshire	12 10/	13 0/	12 10/	13 0/
Do. Lattens, Staffordshire	14 0/	14 10/	14 0/	14 10/
Plates, Ship, Stafford.	10 0/	10 5/	10 0/	10 5/
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	11 0/	11 10/	11 0/	11 10/
Hoops, Stafford	9 10/	10 0/	9 10/	10 0/
Nail Rods, Stafford	9 0/	—	9 0/	—
Swedish in Lond.	13 0/	—	11 10/	—
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 5/	6 10/	6 5/	6 10/
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow				
Scotch warrants	3 1/9	—	2 16/10	—
Do. No. 1	3 3/6	3 17 6	3 1/	3 12 6
Cleveland, Tyne or Tees	3 8/	3 9/	2 18/	3 5/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
Swedish Iron— f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	13 0/	13 10/	11 10/	12 0/
Do. hammered	13 10/	14 0/	12 0/	12 10/
Billets	13 10/	—	12 0/	—
Horse Nail Rods	—	—	—	—
Belgian Iron—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	Nominal.			
Best				
Best Best				
Hammered				
Puddled Steel				
Bessemer				
Hoops				
Rails				
Rolled Girders				
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	15 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	10 5/	10 10/	10 5/	10 10/

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
Scrap (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14/6	—	0 14 6	—
Do. 7 to 8	0 15/	0 15/3	0 15/	0 15/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 ,, 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 ,, 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 ,,16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 ,,24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 30 lb short of an English ton.

OILS, CHEMICALS, &c.

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
Oils (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioja	45 0/	—	45 0/	—
Do. Levant	40 10/	41 0/	40 10/	41 0/
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	45 0/	46 0/	45 0/	46 0/
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	70 0/	71 0/	73 0/	75 0/
Cod	26 10/	27 0/	—	27 0/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	30 15/	—
Do. brown	28 10/	—	28 0/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	33 10/	34 0/	32 10/	33 0/
Palm nut oil	34 0/	35 0/	34 0/	—
Linseed oil	27 5/	—	27 0/	—
Cotton seed oil	27 10/	28 10/	27 10/	28 10/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	37 0/	39 0/	37 0/	39 0/
Do. Ceylon	33 10/	33 15/	33 10/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Lndn.	11 0/	11 5/	11 0/	—
American bls.	10 5/	—	10 5/	—
Do. bags	10 12/6	—	11 12/6	—
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	6 0/	7 10/	6 0/	7 10/
Tallow—PYC.	43 0/	—	43 0/	—
S.Americn. Beef	41 0/	—	41 0/	—
Do. Sheep	38 6/	—	38 6/	—
Australian Beef	34 6/	36 0/	34 6/	36 0/
Do. Sheep	36 6/	38 0/	36 0/	36 6/
Rough Town Fat.	14 0/	—	14 0/	—
Petroleum—				
Fine (per gal.)	0 0/5½	—	0 0/6	0 0/6¼
Do. spirit	0 0/7	0 0/7¼	0 0/7	0 0/7¼
Turpentine—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
Whalefins (per. ton)—				
Davis' Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	1000 0/	1000 0/	1000 0/
Southern	500 0/	—	500 0/	—
Brimstone (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 10/	—	5 10/	—
Roll	8 15/	9 10/	9 10/	10 5/
Sulphur, Flour	10 15/	12 0/	10 15/	12 0/
Acid, (per lb.)				
Acetic, fine	0 0/4	—	0 0/3	0 0/3¾
Do. common	0 0/3	0 0/3¾	0 0/3	0 0/3¾
Citric	0 2/10½	—	0 2/10	—
Muriatic fine (per cwt.)	0 4/	0 7/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0/4½	—	0 0/4½	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/1	—	0 0/1	—
Do. Brown	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Tartaric Crystal	0 1/8	0 1/8½	0 1/8	0 1/8½
Do. Pulv.	0 1/7½	—	0 1/8	0 1/7½
Ammonia—				
Carbonate, per lb.	0 0/6½	0 0/6¾	0 0/6½	0 0/6¾
Sulphate, White & grey (per ton)	19 10/	—	19 0/	—
Arsenic—White Lump (per ton)	24 0/	—	23 10/	—
Powdered, do.	11 3/	—	11 0/	—
Bleaching powder	0 8/9	—	0 8/6	0 8/9
Borax, Rfd., do.	3 5/	3 7/6	3 5/	3 7/6
Copperas (ton)	2 10/	3 5/	2 15/	3 5/
Bi-Sulphide Carbon (per ton)	24 10/	26 0/	24 10/	26 0/
Portland Cement—				
1st quality, in cks 400 lb. gross, inc. cks., f.o.b., Thames, per cak.	0 9/	—	0 9/	—
Do. in sks, 200lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				

	March 4.		March 11.	
	£ s.	£ s.	£ s.	£ s.
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
Hypophosphites (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
Lead (per cwt.)—				
Acetate, best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	1 3/	—	1 3/	—
White	1 4/	—	1 4/	—
Litharge (pr cwt.)	1 1/	1 2/	1 1/	1 2/
Lime (per ton)—				
Acetate, Grey, 85 %	19 0/	—	19 0/	—
Do. Brown 70%	14 0/	—	14 0/	—
Potash—				
Bichromate (lb.)	0 0/6¾	0 0/7	0 0/6¾	0 0/7
Chlorate (pr. lb.)	0 0/7¾	—	0 0/7¾	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1/11	—	0 1/8	0 1/10½
Do. Yel. lb.	0 0/11½	0 1/	0 0/11½	0 1/
Sulphate, 80% (per ton)	14 0/	16 0/	9 0/	10 0/
Saltpetre (per cwt.)—				
Engl. refnd. kgs.	1 7/6	—	1 7/6	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
Soda—				
Ash ... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 12/9	—	0 12/	—
Caustic, 60 %	0 12/	0 14/6	0 12/	0 12/6
Do. 72 %	0 13/	—	0 13/	—
Nitrate (per ton)	—	—	18 15/	—
Crystals (per ton)	4 0/	—	4 0/	—

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

SCOTCH PIG-IRON.

Annexed is a weekly statement of the shipments during this and the previous three years :—

	1880	1879	1878	1877
Week end.	Tons	Tons	Tons	Tons
Jan. 3 ..	6677	4655	2441	3454
10 ..	6689	6069	6085	6500
17 ..	12,288	6291	4532	5141
24 ..	7566	6331	6170	7040
31 ..	13,383	4969	6550	5297
Feb. 7 ..	14,190	6130	5637	6183
14 ..	10,612	7272	5722	5839
21 ..	15,152	8996	5124	6559
28 ..	12,603	8318	7836	8630
March 6 ..	17,968	13,910	6816	8048
,, 13 ..	20,985	10,743	8662	7280
Total ..	138,113	83,684	65,575	68,171

PARTNERSHIPS DISSOLVED.

S. and J. Platt, Wednesbury, ironfounders.—E. Wright and Co., Birmingham, manufacturers of button fasteners.—Croisdale and Co., Leeds, cutlers.—F. G. Cooper and Co., Castle Street, Falcon Square, City, umbrella manufacturers.—Tunstall Colliery Company, Tunstall, Staffordshire; as far as regards M. Scragg.—Dixon and Harris, Gracechurch Street, City, coal factors.—Blackhurst and Tunnicliff, Burslem, earthenware manufacturers.—Crosland and Dickinson, Arnside, Westmoreland, lime burners.

Why Burn Gas? Adopt Chappuis' Reflectors. They supersede gas in daytime, and promote health, comfort, and economy. They are now in great use in private houses. For prospectus address two stamps (I.) Chappuis, Patentee and Manufacturer, 69, Fleet Street, London.—[Advt.]

PRICES CURRENT OF MANUFACTURED GOODS OF BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

As in the iron trade so in hardware, there is a little to report, and as Easter is approaching, added to which the general election, we may expect a quiet time of it for the next month, and probably when all is over we shall know more about the prospects for the remainder of the year. We can at present hear of little improvement in the home trade, but our Board of Trade returns just issued show an increase for the last month in hardware of 7 per cent; but still the returns are far behind 1878. Prices for hardware rule steady in most branches at the late advances, and a stand seems to have now been made; whether it will continue with the present weakness in the iron market remains to be seen. Malleable nails are the only things connected with the iron trade which are altered the last fortnight, and these have been advanced 1s. per cwt. all round. This is on account of the high price to which Bessemer pig-iron has gone, and if competition in this branch had not been so severe no doubt the price of these nails would have gone up before to the present price. The advance on these since they started on the upward course has now been £3 per ton. The metal market still is a little weaker, and this week

RICHARD HOLLIDAY,

HYDRAULIC AND GENERAL ENGINEER,
NEWTON STREET WORKS, BIRMINGHAM.
Maker of the "SPECIAL" Horizontal and Vertical Steam Engine, &c.
AGENT FOR THE PATENT "BISSCHOP" GAS ENGINE.
ALSO FOR "HEAP'S PATENT" SCREWING MACHINE FOR TUBES AND BOLTS.

B. M. RENTON,

Iron and Steel Merchant, Savile Street, Sheffield,
HAS ALWAYS A LARGE STOCK OF
BESSEMER RAIL ENDS
AND
OLD BESSEMER DH RAILS

For Sale in all parts of the country, also Bessemer Billets and Blooms of any size and for all purposes, Old Steel Tyres either whole or broken, Old Springs, Old Files, Cut Bessemer Scrap and Spring Ends for remelting, English and German Spiegeleisen, Swedish and Russian Steel Iron and Box Ends, Swedish Nail Rods and Bundling Iron.

OLD STEEL RAILS.

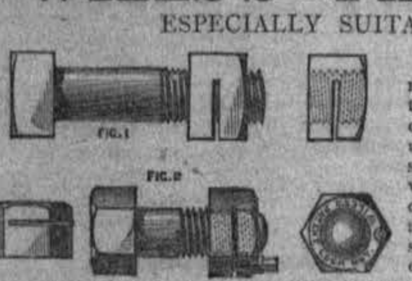
JOSEPH PARKIN,

IRON AND STEEL MERCHANT, SHEFFIELD.
Importer of Spiegeleisen, Russian and Swedish Iron.

A large stock always on hand of the following Materials:—Double-sawn Rail-Ends of all sections, Old Steel Tyres (whole and broken), Old Railway Springs, Bessemer Blooms and Billets, Plating Bars and ordinary Bessemer Bars, for all purposes; Cut Bessemer Scrap, Spring Ends, &c., for crucible melting. Also large quantities of Bessemer Scrap Rail Ends, Bloom Ends, &c., for (Martin-Siemens) re-melting kept in stock at various Ports for shipment.

WILES'S PATENT LOCK NUT.

ESPECIALLY SUITABLE FOR RAILWAY FISH BOLTS.



The advantages of this Lock Nut are as follows:—Simplicity, cheapness, strength, locking on any portion of the bolt without injuring the thread. Fig. 1A shows a RAILWAY FISH NUT with saw-cut partially closed, having been previously tapped, and it is only necessary to screw it upon the bolt in the ordinary manner, when the cut opens and exerts a sufficiently strong spring friction to secure the nut from slacking back by vibration. Fig. 2 shows a nut fitted with set screw, which is more applicable to steam engines and other machinery, especially when the nuts are above 1 inch in diameter, but below that size it is recommended that they should be of steel and applied in the same manner as the fish nut, thereby dispensing with the set screw.

For further Particulars apply to
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18, FINCH LANE, CORNHILL, E.C.
N.B. A large assortment always in stock at Messrs. MOSER & SONS, 178, High St., Southwark, S.E

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On English and American Principles.

ICE-MAKING MACHINES,

Making 5 cwt. to 20 tons ice per day. ENGINES and BOILERS. GAS ENGINES, no coal required.
Gasmaking Machines. Refrigerators. Filters. Syphons. Saltzogenes. Counter Draught Apparatus.
Freezing Machines for Family use.
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Sole Proprietor of Horner's Patent Nozzle and Stopper or Mineral Water Bottles, using Old Bottles and saving Corks and Labour.
Agents for Hayward Tyler and Co.'s Soda-water Machinery.

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COOKLEY IRON AND TINPLATE WORKS, NEAR KIDDERMINSTER.

Manufacturers of BEST, BEST BEST, and CHARCOAL IRON in Bars, Rods, and Sheets; Charcoal and Coke Tin and Terne Plates. Tinned Sheet Iron in all gauges and dimensions up to 96 by 48 inches. Special qualities of Stamping Sheets, Cold Rolled and Close Annealed Iron, Black Taggers, &c., &c.

BRANDS ON IRON AND TERNE,
KNIGHT'S CHARCOAL, KNIGHT'S PLOUGH, KNIGHT'S BT, BT, KNIGHT'S ♛ KBC.
BRANDS ON TIN AND ON TINNED SHEET IRON,
COOKLEY K CHARCOAL. KNIGHT P CHARCOAL. COOKLEY COKE. C.O. COKE.
LONDON AGENT—ARTHUR BIRD, 81, GRACECHURCH STREET E.C.

the associated makers have reduced the price of wire and copper wire sheets, tubes, and rolled wire and copper ¼d. per lb. Copper, which on the 2nd August last was quoted at £59 for tough cake and ingot, stands at £77, and brass and copper goods have risen accordingly. Messrs. Rylands Brothers, of Warrington, have this week reduced the price of their galvanised wire netting 5 per cent. on the nett, the discounts being increased 2½ per cent. Iron is rather easier for common sorts, but marked iron is firm, and shows no signs of weakness. Bars of the former are still quoted by makers not lower than £8 to £8 5s., and marked bars stand at £9.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather doublenailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ⅝ inch, 10/6 to 11/0 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ⅝ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ½ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ⅝ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 47½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 65 to 67½%; end Best solid tower, 60 to 65½%; solid end barrel brass knob, 60 to 62½%; japanned Scotch tower bolts, 45 to 50%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /9¼ to /10 per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /9¼ to /10¼ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11¼ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10½ to /11 per lb.; Brass **Escutcheon pins**, ⅝ by 16 inch, W.G., /10¼ to /11. **Brass jelly pans**, with bails, 11/ to 1/; without bails, 1/ to 1/1 per lb. **Maslin kettles**, cast, 4 to 16 inch, /10½ to 1/ per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /10 to /11 per lb. Brass **Shoe Bills**, 1/1½ to 1/2½ per lb. Brass **Scale pans**, 1/11 to 2/; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅝ inch and above, /10¼ to /11 per lb. Locomotive and marine boiler tubes, seam less from 1½ to 4 inch outside diameter, to 14, W.G., /8½ to /9½.

Copper.—Copper boat nails, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/4 to 1/5 per lb.; Copper **Wire**, 0 to 20 W.G., /10¾ to /11. Brass **cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings** 1/ to 1/6 per gross; **Cornice poles**, 2¾ inch, brass best burnished 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2¼ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¾ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¾ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 10/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 42½ to 47½%; double link, iron, 37½ to 47½%; single link, brass, 37½ to 47½%; registered double link, brass, 32½ to 37½%; close link brass Chain, 5 to 10% brass oval lamp Chain, 22½ to 27½%; brass Clock Chain, 22½ to 27½%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6, japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/. **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅝ inch hook at each end, 19/ to 20/ backbands, 19/6 to 20/6; short link Chain, plain or twisted, ⅝ inch, 18/ to 20/; ½ inch, 16/ to 18/; 1 inch, 14 to 16/ per cwt.; Cart and plough traces, 21/ to 23/ per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 5[illegible], according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 50%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 45%; Common, 70%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 45 to 50% common, 52 to 57½%; kitchen **Fireirons**, in sets, /6 to /7 per lb.; tongs only, /6½ to /7; pokers only, /5¾ to /6 per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/. Cut wire **Fencing staples**, 0 to 6, 22/ to 24/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 61½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 5½ to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 62½%; strong, 40 to 50%; patent Scotch butts, 52½ to 55%; same off broad and

THE LANGLEY MILL

Engineering Wheel & Wagon Co. Limited,
Railway Wagon Builders & Repairers,
MILLWRIGHTS, IRON AND BRASS FOUNDERS, Manufacturers of Solid Wrought-iron Locomotive Engine, Carriage and Wagon WHEELS, CRANKS, AXLES, SHAFTS, and every description of SMITHS' WORK, PIT CAGES.
METAL TUBBING,
ALL KINDS OF COLLIERY CASTINGS, AND EVERY VARIETY OF
CRUCIBLE STEEL CASTINGS.
LANGLEY MILL, near NOTTINGHAM.

ISSUE OF £250,000 SIX PER CENT. "B" MORTGAGE DEBENTURES OF THE

WESTERN AND BRAZILIAN TELEGRAPH COMPANY

(LIMITED).

THE DIRECTORS OF THE COMPANY ARE—

CHAIRMAN.
SIR EDWARD WATKIN, M.P.
DEPUTY-CHAIRMAN
SAM MENDEL, ESQ.

W. S. ANDREWS, ESQ.
HENRY COOKE, ESQ.
EDWARD CROSS, ESQ.
HENRY WEAVER, ESQ.

Debentures A, Six per Cent. .. .. £200,000.
" B " .. .. £300,000.
Share Capital, £1,398,200 fully paid.

The £250,000 of B Debentures now offered (part of the authorised issue of £300,000, the balance of £50,000 being reserved) will be applied (1) in redemption of the present B and C Debentures and (2) in providing the funds for placing the company's cables in complete working order. They are secured by a mortgage on the property of the company, ranking next after the £200,000 of A Debentures, and the charge of the London Platino-Brazilian Telegraph Company (Limited), and bearing interest from March 2, 1880, payable in London half-yearly on February 2 and August 2, and redeemable by annual drawings, payments commencing February 2, 1890, and terminating February 2, 1910.

The first warrant for five months interest will be payable on August 2 next.

The Alliance Bank (Limited) are authorised to receive applications of the above debentures, payable as follows:—

£5 per £100 Debenture on application.
£95 " " on allotment.

The subscription-list will be closed on or before Saturday, March 20 instant.

Default in the due payment of the balance will render previous payment liable to forfeiture.

Debenture bonds of £100 each, registered in the names of the allottees, will be issued as soon as possible against allotment letters and bankers' receipts.

Where no allotment is made, the deposit will be returned without deduction; and when a partial allotment is made, the surplus deposit will be applied towards the amount payable on allotment.

Holders of the existing B bonds, who desire to convert the same, will secure the allotment of an equal amount of the present issue by depositing the bonds at the Alliance Bank (Limited), Bartholomew Lane, E.C., before the closing of the subscription-list, with an application on the accompanying form marked B.

As the existing B bonds bear interest from February 2 last, the depositor will receive with his new bonds a cheque for interest at 6 per cent. per annum from that day to March 1st instant inclusive.

Holders of C bonds may also exchange their bonds for those of the new issue, by depositing them in like manner, with an application on the accompanying form C.

No cash payment will be required with the bonds so deposited.

Depositors of bonds will receive a receipt for the same, entitling them to an equivalent amount of paid-up scrip.

The Western and Brazilian Telegraph Company (Limited), holding a concession from the Government of Brazil, ending 1933, was incorporated in April 1873, for the purpose of laying and working cables from Para to Maranham, Maranham to Pernambuco, Pernambuco to Bahia, Bahia to Rio Janeiro, Rio Janeiro to Santos, Santos to St. Catherina, and St. Catherina to Rio Grande, and by an agreement dated 23rd May, 1873, with the Companhia Telegraphica Platino-Brazilieira, now the London Platino-Brazilian Telegraph Company (Limited), acquired the southern cables from Rio Grande to Monte Video, in consideration of the payment to that company of one-fifth of the gross receipts of the whole system. The total length of the cables is 2845 miles.

The directors state in their last published report:—"The result of the operations thus far concluded has been to substitute, at the cost of the revenue, iron-sheathed cable, in lieu of the existing deep sea type, for a distance in all of 790 miles, out of a total of 2845 miles, or, in other words, to renew more than one-fourth of the system.

"Notwithstanding the numerous interruptions to which the company's cables have been subjected, the revenue has provided funds to enable the company to meet with punctuality the debenture interest when it has become due, and to defray the exceptional outlay consequent upon so extensive a renewal of its lines."

The receipts for the first 22 weeks of the current year as published (viz., Oct. 1, 1879, to Feb. 28, 1880), average £2833 per week, being at the rate of £147,300 yearly, and are in the aggregate £8406 in excess of the highest receipts for the corresponding period of any previous year, leaving (after payment to the London Platino-Brazilian Company) £117,840 as the revenue of this company. After deducting from this amount the £12,000 per annum interest on the A debentures, and the £15,000 per annum required for interest on the present issue (together £27,000), there would remain £90,840 to meet the working expenses of the company, and for the payment of dividend on share capital.

The directors have already arranged with the Telegraph Construction and Maintenance Company for 400 miles of iron-sheathed cable, to be laid as and when necessary, so that no time may be lost in perfecting the whole system of the company's cables. The engineer's report states that this quantity of cable will amply suffice for the requirements of the company. It is confidently expected that when this shall have been accomplished the income will be greatly increased, and the annual charges for repairs will be less.

A deed of trust will be executed, charging the undertaking of the company with payment of the whole of the debentures of this series, irrespective of their date of issue, subject to the £200,000 A Debentures, and the charge of the London Platino and Brazilian Telegraph Company (Limited), and powers of sale will be vested in the trustees to be exercised after 12 months' default in payment of any principal or interest-money in respect of any debentures secured by the trust deed.

The concession of this company, and the agreement with the London Platino-Brazilian Telegraph Company (Limited), may be inspected at the offices of Messrs. Bischoff, Bompas, Bischoff and Co., of 4, Great Winchester Street, E.C., the solicitors to the company.

Prospectuses and forms of application may be obtained at the Alliance Bank (Limited), Bartholomew Lane, E.C., and Mr. W. Cuthbert Quilter, 14, King's Arms Yard, London, E.C.

London, March 12, 1880.

(To be retained by the Bankers.)

Issue of £250,000 Six per Cent. Class B Mortgage Debenture Bonds of the Western and Brazilian Telegraph Company (Limiteo), Crown Court, Old Broad Street, London, E.C.

FORM OF APPLICATION.

To be sent to the Alliance Bank (Limited).

To the Alliance Bank (Limited).

Having paid to you the sum of £ , I request that you will put forward my application for an allotment to me of £ debentures of the above issue, and I hereby agree to accept such debentures, or any smaller amount that may be allotted to me, and to pay the balance thereon according to the terms of the prospectus dated 12th March, 1880.

Signature ....
Full name ....
Address ....
Description ....
Date ....

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narrow. Patent table, bed and back-flap hinges, 50 to 52½%; extra strong bed hinges, 42½ to 55%; patent chest, 45 to 47½%; patent strap, 45 to 55%. **H Hinges**, 40 to 55%; HL hinges, 40 to 55%; japanned and garnett hinges, double washered, light and strong, 35 to 40%; best best patent London or Lancashire tees, 52½ to 60%; patent light japanned Scotch Tees, 55 to 62½%; light patent hooks and hinges on plate and to drive, 20 to 25%; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned, Tees double washered, 20/6 to 23/6; Gothic Scotch japanned, Tees 23/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/. **Wrought hinges**, common and best, 35 to 40%; best best, 30 to 35%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 27/ per cwt.; **Lancashire hinges** wrought, 30 to 35%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net **horseshoes**, fullered fore, 18/ to 20/; fullered hind, 19/ to 21/; stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. **Hollowware**, 45 to 50%; common to best, enamelled, 20 to 25%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 11/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 9/6 to 10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 9/6 to 10/; cart bushes, 11/6 to 13/6; camp ovens, 10/ to 11/; cooking stoves, 12/6 to 13/6; cogs for blocks, 17/ to 19/; cellar grating, 10/6 to 12/6; clock weights, 9/ to 11/; Dutch stoves, 11/ to 13/; dumb bells, common, 9/ to 11/; best best japanned, 19/ to 21/; frying pans, cast handles, 12/6 to 14/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4; galvanised furnaces up to fifty gallons, /9 to 1/ per gallon; furnace doors, 12/ to 14/; furnace grates, 9/6 to 11/6; forge backs, 12/6 to 13/6; heaters for box irons, 8/6 to 10/6; heaters for urns, 10/ to 11/; jack wheels, 18/ to 20/; oven doors and frames, 12/ to 14/; pots, three legged, Danish, plumbers', and Nego, 10/ to 12/; plumb bobs, 13/6 to 15/6; pudding pans, 13/6 to 15/; pump spouts, 14/ to 16/; sash weights, 8/6 to 9/6 ditto, with pulleys, 11/ to 13/; shoe anvils, 11/6 to 12/6; slippers 12/6 to 13/6; **Italian irons**, 35 to 40%.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; **keys and banks**, 50 to 55%; extra strong plate, 30 to 37½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter **knobs**, 52½ to 57½%; brass cupboard turns, 52½ to 57½%; brass drawer knobs, 52½ to 57½%; brass ash pan knobs, 52½ to 57½%; brass range knobs, 35 to 40%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 62½ to 76½; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, best, 55 to 65% common **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned struck **ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Netting, wire, galvanised, 57½% to 62½%, delivered **Cast nails lath**, 10/6 to 11/6 per cwt.; cast wall nails 9/6 to 12/ per cwt.; cast headed bills, ¾ by 8 ounce, 15 to 16/; fine round cast bills, ¾-inch, 14/ to 16/; strong round cast bills, ¾-inch, 13/ to 16/; cast slate pegs, 13 to 17/; cast garden loops, 15/ to 17/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut-nails**, clasp, clout or rose nails, 3 inch and upwards, 11/ to 12/6 per cwt. cut lath nails, 1 inch and upwards, 14/ to 15/6; cut flooring brads, 2½ inch and upwards, 11/3 to 12/9; fine cut tacks, ½ inch, 35/ to 38/ per cwt.; ¾ inch 31/6; 1 inch, 27/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 16/ to 18/; 2 inch, 15/ to 17/6; 2½ inch, 15/ to 17/; 3 inch, 14/ to 15/6 per cwt.; cut shoe bills, strong, or 12 W.G., 13/6 to 15/6 per cwt.; middle, or 14 W.G., 13/ to 15/; fine, or 15 W.G., 15/6 to 16/6; fine cut tacks, per packet, 75 to 80%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 15 to 17½%; best countersunk clout nails 1, inch, 35/6 to 37/6; 2 inch, 26/ to 27/6; 2½ inch, 22/ to 25/6; best best countersunk and **half-countersunk horse nails**, fine best; Swedish charcoal iron, 17/6 to 19/6% list prices wrought rose or lozenge-head **spikes**, 4 inch, 15/6 16/, 5 inch, 15/6 to 16/; 6 inch, 15/ to 16/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 21/6 to 22/6; 2½ inch, 13 lb., 20/ to 21/; 3 inch, 20 lb., 19/ to 19/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking; moulders' nails and chaplets, 1½ inch to 3 inch, 28/ to 29/; bright nuggets, 28/6 to 29/; tile pegs, 15/ to 16/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 39/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 29/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 23/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Oddwork, tinned and black, 15 to 20% list; **Paris pointes**, best English, 15/6 to 16/; foreign, 18/ to 20/; **planes**, 25 to 30%; iron **axle pulleys**, 1¾ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; H. F. and wheel, 48/ to 60/ per gross; brass escutcheon **pins**, ¾ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ¾ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ¾ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ¾ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 40 to 52½%; strong, 30 to 35%; Lancashire plate locks, 25 to 30%; pewter measures, 25 to 30%.

Riddles, 30 to 35%; **Rivets**, iron boot rivets, /3½ to /4 per lb. patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ¼ inch, 23/ to 24/; ¾ inch, 18/ to 19/; ½ inch, 17/ to 18/; ¾ inch, 16/ to 17/. Delivered in London or Liverpool; machine-made wire Rivets, ¾ inch, 14/6 to 15/6 per cwt. **Rakes**, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Spades and Shovels, common, 52½ to 55%; second, 35 to 40%; best 30 to 35%; best strong country Shovels; 25 to 30%; best hammered Spades and Shovels, 5 to 10%; **Ship Scrapers**, black steel blades, 45 to 50%; bright, 42½ to 47½%; cast-steel black, 42½ to 47½%; bright, 37½ to 42½%; best cast-steel black, 35 to 40%; bright, 30 to 35%; iron **Wood Screws**, 65%; brass wood Screws, 60 to 62½%; copper, 35 to 45%; Stove Screws, 50 to 57½%; dowel Screws, 60 to 65%; brass headlock Screws, 40 to 47%; gilt, silvered and plated head Screws, 40 to 45%; jute **Sash cord**, 52½ to 57½%; flax Sash-cord, 25 to 30%; best flax, 5 to 10%; super flax, 7½ to 12½%; extra super flax Sash-cord, 5 to 10%; patent steel ribbon **Sash-line**, 25 to 35%; copper **Sash-chain**, 52½ to 57½%; zinc Sash-chain, 47½ to 52½%; iron prepared, 40 to 45%; copper Sash-cord, 15 to 20%. **Sad irons**, common, 10/6 to 12/ per cwt.; best japanned, 13/6 to 16/6; best best japanned, 18/ to 20/ per cwt.; **Shoe heels**, York, No. 1, 3/5 to 3/8; No. 2, 4/ to 4/3; No. 3, 8/ to 8/9 per gross net; Dundee hot turned, 5/9 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/; bright York 6t ft, 8/ to 8/6; bright solid, 6/6 to 7/; toe plates, 9/6 to 10/ per gross. **Stair rods**, turned ends, 75 to 80%; solid fancy ends, 60 to 65%; cased tube, 30 to 35%; patent solid ornamental, 35 to 40%. **Sofa Springs**, coppered, 8 by 6 inches, 25/ to 27/ per gross; 9 by 7 in, 21/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised **Waterloo Scoops and hods**, 17/6 per doz.; japanned Waterloo scoops and hods, 16 inch, 15/ to 16/; japanned scoops and hods, light, 16 inch, 15 to 16/ per doz.; **Shutter bars**, common spring, broad and double, 75 to 77½%; Scotch iron drop, 77½ to 80%; brass drop, 70 to 72½%; brass drop and catch, 67½ to 70%; registered brass spring box shutter bars, 52½ to 67½%; double-handed brass spring box, 57½ to 65%; **Saddlers' tools**, 5 to 10%; **Stocks and Dies** for smiths' use, 35 to 40%; ditto for engineers, 10 to 20%; **Steel toys**, 10 to 30%.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 50%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates, I C**, 36/ to 38/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ¾ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brazed tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 60 to 62½%; fittings, 62½ to 65%; iron **Water Tubes**, 50 to 52½%; fittings, 52½ to 55%; iron **Steam Tubes**, 45 to 47½%; fittings, 47½ to 50%; galvanised iron gas Tubes, 45 to 47½%; fittings, 47½ to 50%; lap-welded **Boiler Tubes**, 47½ to 50%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 32/ to 34/ per cwt.; common bright, 40/ to 42/ per cwt.; black staples vices, solid box black, 42 to 48/; bright, 41/ to 47/; solid box, black staple, with spherical washer, 40/ to 45/; bright 51/ to 55/.

Washers, light iron, 70%; heavy washers, 13 to 16 lb., W.G., 12/6 to 13/ per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvanised oval, 22 inch, 29/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 14/6 to 15/6 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No. 18, 4/ to 4/3 per stone 14 lb.; cut tinned bottling wire, No. 22, 4/11 to 5/9 per stone 14 lb.; weaving and binding wire, No. 23, 4/ to 4/2 per stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone 14 lb. net; cast steel wire, 0 to 6, /9½ per lb.; 10 to 20%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¾ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 1¾ inch diameter, /½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 14/6 to 15/ per cwt.; annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to 6, round or oval 16/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6 per cwt.; galvanised rolled, 1 to 4, 14/9 to 15/9 per cwt.

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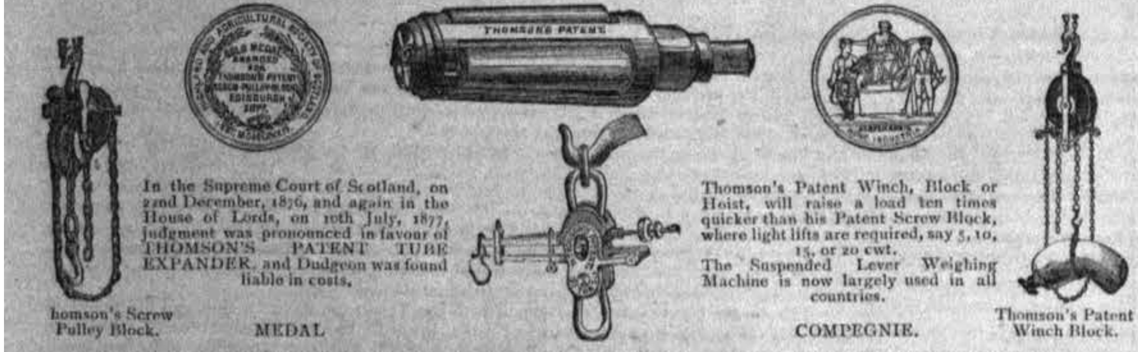

In the Supreme Court of Scotland, on 22nd December, 1876, and again in the House of Lords, on 10th July, 1877, judgment was pronounced in favour of THOMSON'S PATENT TUBE EXPANDER, and Dudgeon was found liable in costs.

Thomson's Patent Winch, Block or Hoist, will raise a load ten times quicker than his Patent Screw Block, where light lifts are required, say 5, 10, 15, or 20 cwt.
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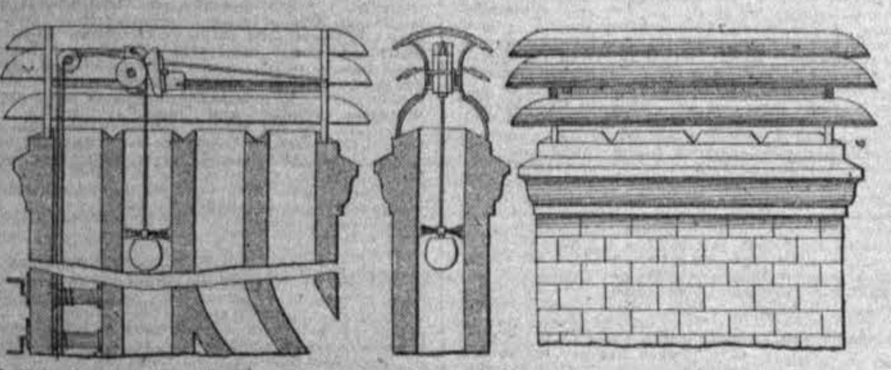

A Model of the Apparatus, and a full-sized Machine fitted complete, together with Testimonials, can be seen, and further particulars as to price, merits, &c., obtained on application to Patentee,
WILLIAM ROSS,
2, CRANE COURT, FLEET STREET, E.C.

J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

Chemicals.—There is still a considerable amount of quietness about chemical business that a few weeks ago was a stranger to it. Towards the close of the week, however, a slight favourable reaction has taken place, principally in the direction of an increase of inquiry, and a rather larger business is the result, though of course nothing approaching in animation that of the late activity. Contract business attracts more attention, and buyers more freely make known their requirements. Their ideas of value, however, are strongly opposed to those of sellers in many instances, and it is therefore difficult to conclude negociations satisfactorily, and avoid a dead lock. This feeling seems wearing off, and doubtless sellers and buyers will rise to the position more buoyantly shortly. The range of prices is without material alteration, though, if anything, they have lost some of their weakness. During February, 16,917 tons of alkali were exported, against 16,616 tons in the corresponding month of last year. During the two completed months of the year the total exported was 41,967 tons, against 39,711 tons to the end of February, 1879, the respective values £315,974 and £241,770, which shows an average increase in favour of the present year of 28s. per ton, or say, 25 per cent. Cream and white caustic soda are at the moment a shade firmer in some cases, but this is by no means general. Ash, on the other hand, is offering on rather easier terms. Bleaching powder is offered more freely, and sellers are not indiposed to hold out inducements to probable buyers. Acids are still firm, and makers are well sold, excepting in the case of oxalic. Sulphates are somewhat neglected. Arsenic is unchanged. Acetate of lime is held for full prices.

Minerals.—There is little alteration to report in these articles, most of them having been stationary all the week as far as prices are concerned, and the tendency being towards a decrease in the bulk of trade. This is to be attributed, in a great measure, to the relapse which has taken place in commerce generally, and of course this branch has not escaped the influence. Brimstone has lost much of its firmness, and holders are more eager to quit. Foreign advices give the article in good demand for forward delivery, but buyers averse to give any advance over prices for current. It is estimated that a total of 87,857 tons of thirds and seconds were exported from Girgenti, Licata and Catania. Iron ore is still in excellent demand, but there is an unmistakable absence of that pressure for supplies until lately noticeable; all good brands, however, continue to bring full prices. China clays are subject of much attention, and fair sales have been made at a shade of improvement in price. Ochres also move more freely.

Metals.—The condition of the pig-iron market has undergone very little material change since last week. The continuance of a quieter tone in the American demand, has had a serious adverse effect on two of the principal Northern markets, but beyond this, the trade does not appear to be in any worse state, for in other districts some slight recovery towards renewed steadiness is observable. This is the case in regard to hematites, the underselling being confined to the holders of second-hand parcels. Makers hold out for full prices, and do not seem disposed to give way. Lancashire brands also are steadier than they were, there, in reality, not being very much iron on hand requiring placement, and manufacturers being fairly well booked for their production. Lincoln and Derbyshire irons on the other hand are a shade easier, but this is very slight. Glasgow warrants have, through the foregoing cause, and the action of "bearing" operators fluctuated greatly. On Tuesday they reached 61s, per ton, and continued downwards till Friday, touching 59s. Although it was thought Middlesborough was fast losing its sympathy with Glasgow, this has proved a mistake, as the utmost irregularity has ensued in its prices, No. 3 being offered at 57s. per ton, though it was sold at less than this during the week. Tin has suffered to the extent of about £3 per ton. Copper also fell away greatly, but it has since recovered some 30s. per ton. Lead is fairly steady.

General Items.—During February, 8841 tons of iron rails and 21,486 tons of steel rails were exported. For the two months January and February, 19,984 tons of the former, and 50,402 tons of the latter were exported. The respective values of the latter were, £116,624 and £303,121.

Manchester, March 13th, 1880.

BUSINESS CARDS.

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Falcon Works.
SMETHWICK NEAR BIRMINGHAM,
Manufacturers of all kinds of Engineers', Machinists', Carriage and Coach
BOLTS AND NUTS;
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Or Cut to Shape for Steam Joints,
AND FOR GAS ENGINES,
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All Asbestos Goods of the best quality manufactured by
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FIRE BRICKS and BLOCKS for the highest heats for Iron blast-furnaces, forge, rolling, puddling and steel furnaces, pottery, bottle and flint glass furnaces, copper, calcining, roasting, and refining furnaces, chemical works, coke ovens, boiler seat blocks, locomotive bricks, &c.
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"ALEX. CRICHTON,
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"It is the most efficient lubricant we have ever tried.
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"We enclose order for one ton, which is the best proof we can give you of our satisfaction.
"JAMES HUMPHRYS,
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"Work is considerably lessened, and 60 to 70 per cent. is saved.
JAMES MACLAY,
"Chief Engineer S.S. 'Albicore,' Granger."

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AN ENGLISH COLONY IN TENNESSEE.—A Cincinnati despatch, dated Feb. 20th says: John Boyle of London, England, trustee and manager of the estate of the Marquis of Bute, the Sir Putney Giles of Disraeli's great work, has just arrived here, returning from a visit to the Cumberland plateau in Tennessee, two hundred miles south of this city, on the Southern railroad. He and other English capitalists and people of position have decided to plant a huge colony on the plateau, with thousands of colonists, some from the highest social ranks of England. They will immediately begin work upon some thousands of acres of land they have purchased, laying out a town, building manufactories for iron and wood, erecting buildings, &c., and hope to make this a most prosperous and extensive colony.—*American Manufacturer.*

AN AMERICAN RAINMAKER.—Gen. Daniel Ruggles, of Virginia, at the request of the Senate Committee on Agriculture, appeared before them a few days ago, and briefly explained his method of precipitating rainfalls by scientific means. His method (for which he has recently been granted a patent) is to send up to the cloud realm cartridges of dynamite or similar explosive materials in skeleton balloons, and to explode them, either by time fuses or by magneto-electricity, through light metal wire connecting the balloons with the earth. Gen. Ruggles, as the result of many years of study and investigation of this subject, claims that the diffused mists passing over regions or localities suffering from unusual drought may readily be consolidated into rainfalls by concussions and vibrations thus artificially produced, and he has, therefore, suggested to the committee that Congress might provide a small appropriation for expenditure by the Commissioner of Agriculture, to test the practicability of aiding the agricultural interests of the country in this manner. The committee listened to Gen. Ruggles' statements with much interest, and requested him to prepare an amplified memorial on the subject with a view to their taking it more fully into consideration at an early day.

BLAKE'S PATENT DIRECT-ACTING STEAM PUMP.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN:
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HYDRAULIC AND GENERAL ENGINEERS,
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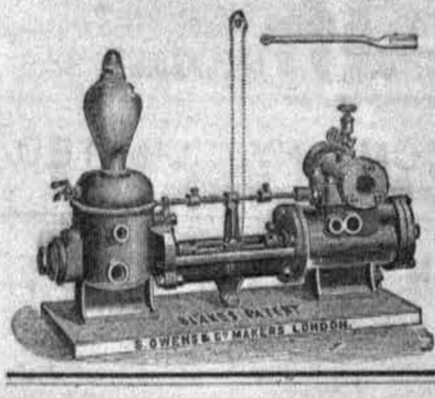
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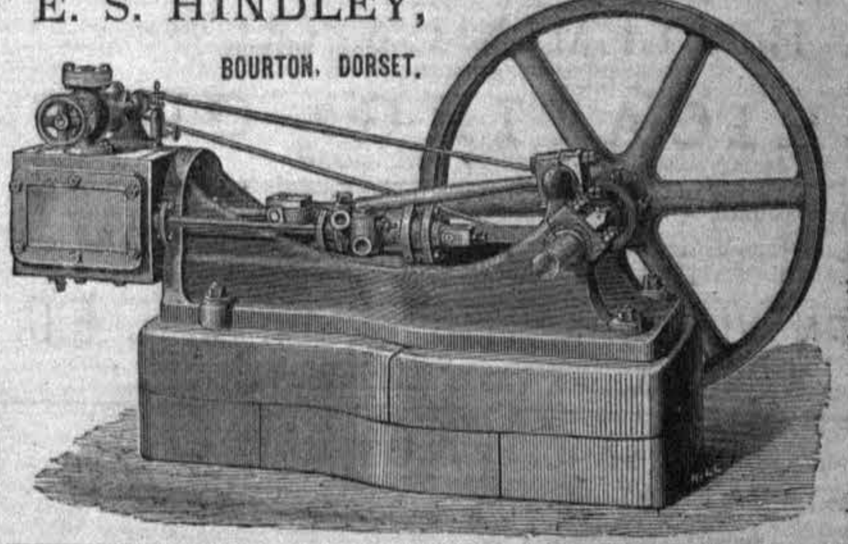

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REFINED OILS, ranging in body from Castor Oil, to the finest Sperm Oil, and adapted to every class of machinery, from the heaviest shafting to the lightest spindle. Guaranteed free from any tendency to gum or clog.

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NATURAL OILS of dark Colour, graduated in body from Castor Oil to Tallow Oil, limpid at 32 deg. Fah. Adapted for stationary and locomotive engines, shafting and heavy machinery, screwing, boring, &c.

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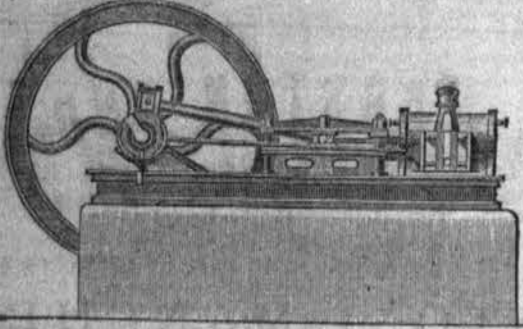

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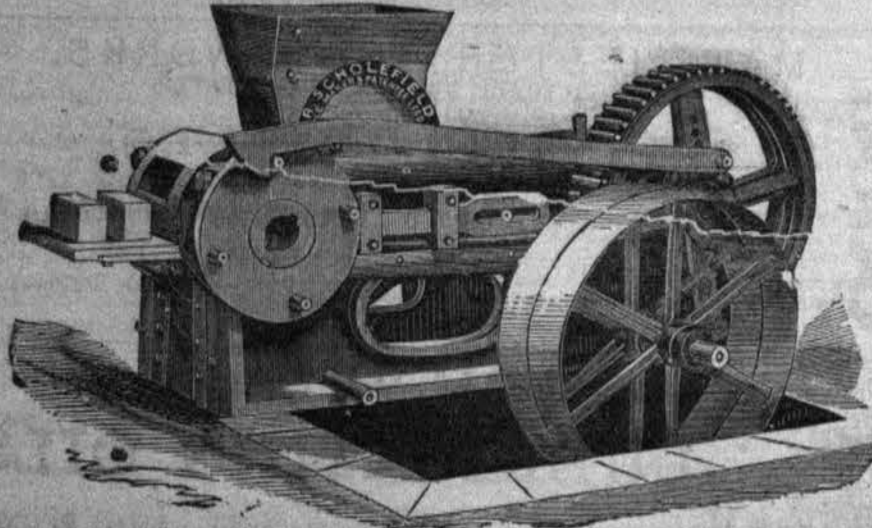
R. SCHOLEFIELD'S
LATEST PATENT BRICKMAKING MACHINE.
PATENTED 1873.



R. S. begs to call the attention of all Colliery Owners in particular to his PATENT SEMI-DRY BRICK MACHINE, and the economical method of making bricks by his patent machinery from the refuse that is taken from the pits during the process of coal-getting, which, instead of storing at the pit's mouth (and making acres of valuable land useless), is at once made into bricks, at a very small cost, by R. S.'s Patent Brick-making Machinery. If the material is got from the pit hill, the following is about the cost of production, and the hands required to make 10,000 pressed bricks per day.

2 men digging, each 4s. per day	£0	8	0
1 man grinding, 4s. 6d. per day	0	4	6
1 boy taking off bricks from machine, and placing them in barrow ready for the kiln, 2s. per day	0	2	0
1 boy greasing, 1s. 6d. per day	0	1	6
1 engine-man, 5s. per day	0	5	0
1 man wheeling bricks from machine to kiln, 4s. 0d. per day	0	4	0
Total cost of making 10,000 pressed bricks	1	5	0, or 2s. 6d. per 1000

(SETTING AND BURNING SAME PRICE AS HAND-MADE BRICKS.)

N.B.—Where the material can be used as it comes from the pit, the cost will be reduced in digging.

As the above Machinery is particularly adapted for the using up of shale, bind, &c., it will be to the advantage of all Colliery Owners to adopt the use of the said Brick-making Machinery.

The Machines can be seen in Operation at the Works of the Sole Maker and Patentee daily.
PATENT BRICK MACHINE WORKS, NEAR VIADUCT, BURLEY VALE, BURLEY, NEAR LEEDS.

THE
ANGLO-AMERICAN
ELECTRIC LIGHT COMPANY, LIMITED,
IS NOW PREPARED TO
BOOK ORDERS FOR THE SUPPLY OF
MACHINERY AND LAMPS
UPON THE BRUSH SYSTEM FOR LIGHTING UP
Factories, warehouses, railway stations, docks, and other places for which such illumination is suitable.

All orders received will be executed, so far as is practicable, in rotation.

The Company is also prepared to receive from Corporations or private persons applications for licenses, or for concessions for defined districts.

The Anglo-American Electric Light Company (Limited) is also willing to enter into negotiations with responsible parties for the sale of licenses for the British Colonies. The superiority of the Brush system over all others in economy and simplicity has been now established in the United States as beyond question, and its rapid development in this country, now that it has been introduced, may be regarded as a certainty. G. R. DAVIES, Secretary.

Office, 74, Hatton Garden, E.C.

Clerical, Medical, and General Life
ASSURANCE SOCIETY.
13, St. James's Square, London, S.W.
City Branch: Mansion House Buildings, E.C.
DISTINCTIVE FEATURES.
Credit of half the first five Annual Premiums allowed on whole-term Policies on healthy Lives not over 60 years of age.

Endowment Assurances granted, without Profits, payable at death or on attaining a specified age.

Invalid Lives assured at rates proportioned to the risk.

Claims paid thirty days after proof of death.

BONUS.

The Reversionary Bonus at the Quinquennial Division in January, 1877 (amounting to £357,014), averaged 50 per Cent., and the **Cash Bonus** 30 per Cent., on the Premiums paid in the 5 years.

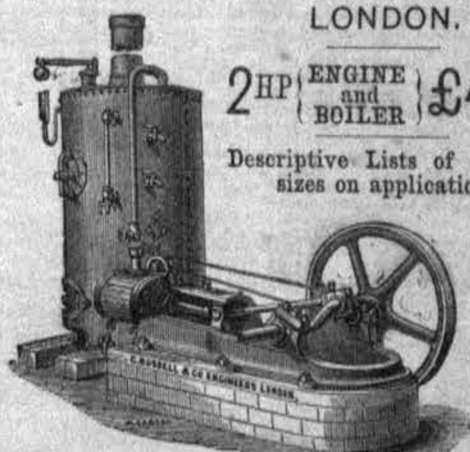
The Next Division of Profits *will take place in January, 1882, and Persons who effect* **New Policies before the end of June next** *will be entitled at that Division to one year's additional share of Profits over later Entrants.*

REPORT, 1879.

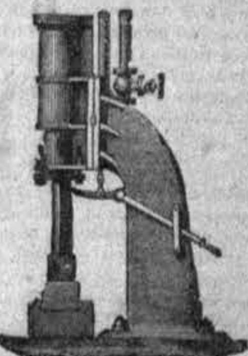
The **55th** Annual Report, and the latest Balance Sheets rendered to the Board of Trade, can be obtained at either of the Society's Offices, or of any of its Agents.

GEORGE CUTCLIFFE, Actuary and Secretary.

C. RUSSELL & CO.,
2, TALBOT COURT, GRACECHURCH ST.,
LONDON.


C. RUSSELL & CO ENGINEERS LONDON

2HP {ENGINE and BOILER} £45.
Descriptive Lists of larger sizes on application.



DAVIS & PRIMROSE,
ETNA IRONWORKS,
BANGOR ROAD,
LEITH, N.B.,
MAKERS OF
STEAM HAMMERS, PUNCHING AND SHEARING MACHINES,
SHIPBUILDERS' and BOILERMAKERS'
TOOLS.

FOR MINING, ENGINEERING AND GENERAL MECHANICAL PURPOSES

LEATHER INDIA-RUBBER GUTTA-PERCHA

GEO. ANGUS & Co NEWCASTLE-ON-TYNE AND LIVERPOOL.

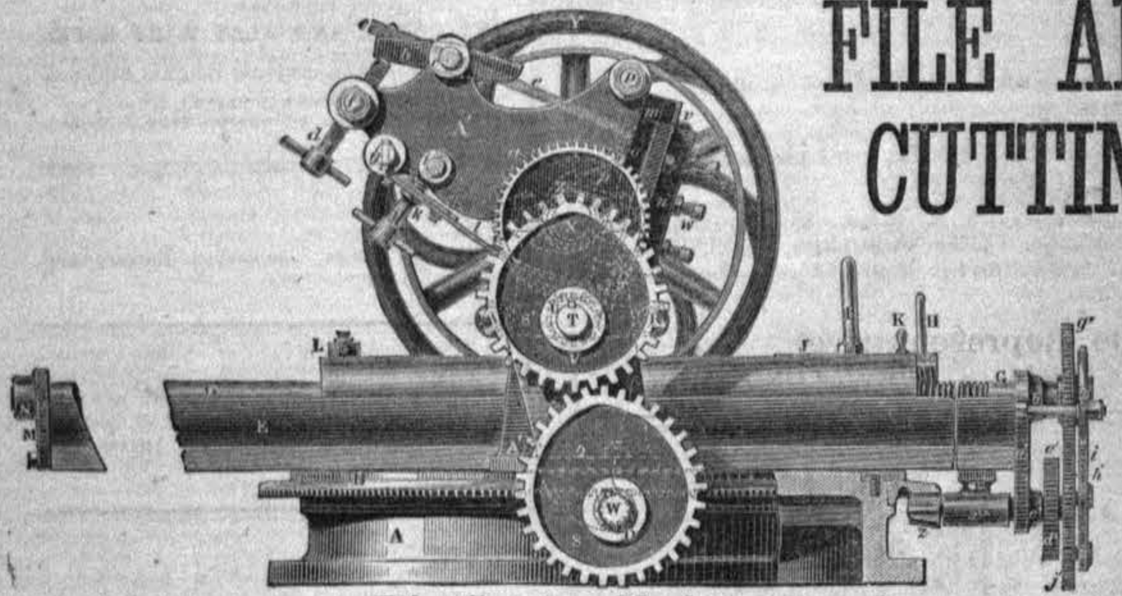
FOR SALE OR BUSINESS ARRANGEMENT.

FILE AND RASP CUTTING MACHINES.

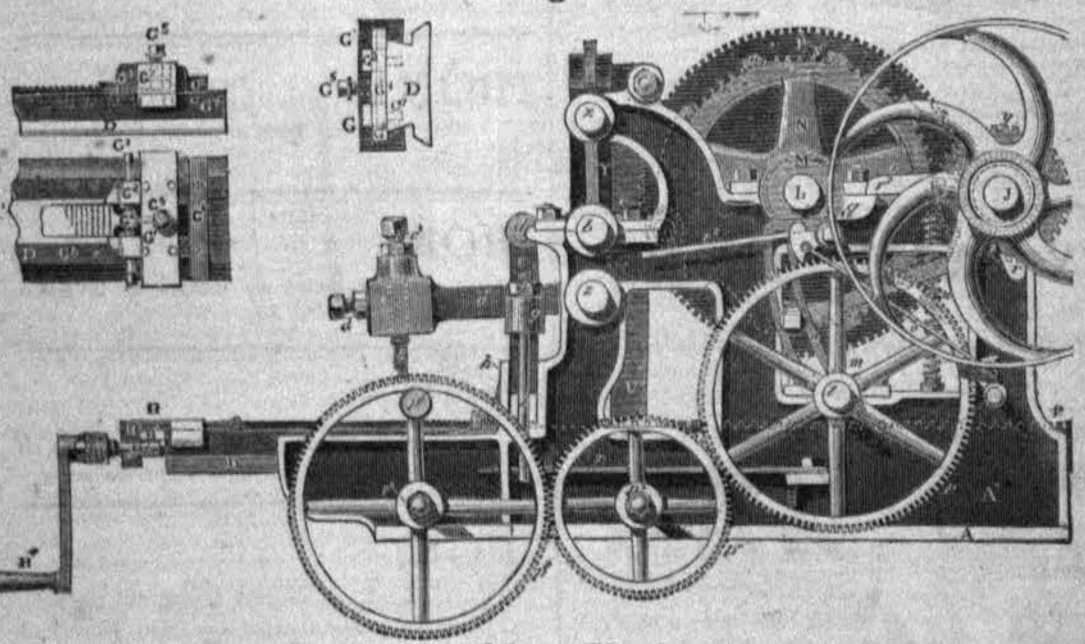
THE PATENT RIGHTS OF THESE MACHINES, Taken out in January, 1878, are now offered.

FOR FULL *Illustrated Description,* see *"IRON,"* November 7th, 1879.

FURTHER PARTICULARS GIVEN AND ARRANGEMENTS MADE TO SHOW THE MACHINES IN OPERATION, BY



File Cutting Machine.



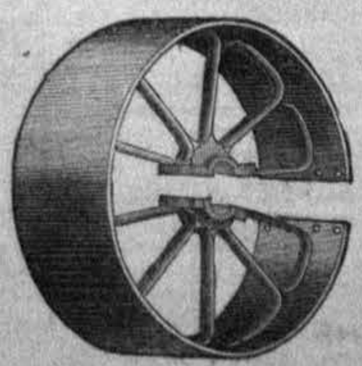
Rasp Punching Machine.

T. W. LEE,

2, Pancras Lane, Queen Victoria Street, London, E.C.

LOSS OF TIME IS LOSS OF MONEY.

ACCIDENTS CAUSE LOSS OF TIME.
And may be provided against by a policy of the
RAILWAY PASSENGERS ASSURANCE COMPANY,
The Oldest and Largest Accidental Assurance Company.
Rt. Hon. LORD KINNAIRD, Chairman.
SUBSCRIBED CAPITAL, 1,000,000.
MODERATE PREMIUMS.
BONUS ALLOWED TO INSURERS OF FIVE YEARS' STANDING.
A fixed sum in case of Death by Accident, and a Weekly Allowance in the event of Injury.
ONE MILLION AND A HALF HAS BEEN PAID AS COMPENSATION.
Apply to the Clerks at the Railway Stations, the Local Agents, or 64, CORNHILL, LONDON WILLIAM J. VIAN, *Secretary.*



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Simple, Light, Elastic, Strong, Durable & Cheap (Mackie's Patent).

WILLIAM LINCOLNE & Co.

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To Save Both Bands and Belting Use "L." Belting Syrup.

JOHN MARSHALL & SONS,

(Late MARSHALL and WYLIE),

GLASGOW TUBE WORKS, GLASGOW.

MANUFACTURERS OF

LAP-WELDED STEEL AND IRON BOILER TUBES,

For Marine and Stationary Boilers, Locomotive and Portable Engines, &c.,

Supply the principal Engineers and Shipbuilders on the Clyde, and have a large Home and Foreign connection.

Locomotive Iron Tubes with Copper Ends.

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NEW YORK: 58, HUDSON STREET.
SAN FRANCISCO: 22 & 24, FREEMONT STREET.

THE LANDORE-SIEMENS STEEL CO., LIMITED

DIPLOMA OF HONOUR, VIENNA, 1873.

GOLD MEDAL, PARIS, 1878.

Contractors to the Admiralty, British and Foreign Governments.

MANUFACTURERS OF

STEEL PLATES FOR SHIPS, BOILERS,

AND GENERAL WORK.

SHEETS, ANGLES, TEES, BULB BEAMS of all Sections. "S. S." Brand, Special Quality for BOILER-FURNACES, TUBE-PLATES, &c. AXLES, TYRES, FORGINGS, CASTINGS,

Weldless Angle and Flat Rings for Boilers, Weldless Dredger Bucket Mouths, Ingots, Blooms, Billets Bars, Wire Rods, &c.

D. CAMPBELL, (Sole Representative),

3, WESTMINSTER CHAMBERS, VICTORIA STREET, LONDON, S.W.

CAST IRON PULLEYS.

As shown below or in halves, made any diameter or width.

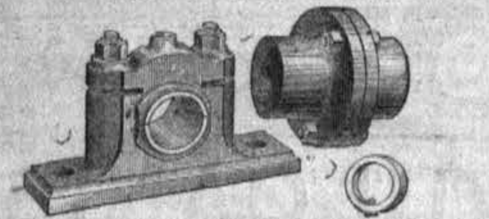
TAYLOR & CHALLEN,

DERWENT FOUNDRY,
BIRMINGHAM.

For each extra 1 inch in width add 10 per cent. to following prices:

LEADING SIZES AND PRICES, TURNED AND BORED.

Diameter in inches	6	8	10	12	15	18	21	24	28	32	36	42	48	54	60
Width, ditto ...	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6
Price, Split, shillings ...	8	9	10	11	14	17	20	25	32	38	46	55	66	95	110
Do. Plain do....	5	6	7	8	10	13	16	20	25	30	38	45	55	80	90



Plummer Blocks, with brasses and bolts, planed, bored, &c. Couplings, bored, faced, keywayed, and with turned bolts. Loose Collars of wrought iron bored, turned, and steel screws.

STOCK, SIZES, and PRICES, delivered here.

Bore, in inches to standard ...	1¼	1½	1¾	2	2¼	2½	2¾	3
PLUMMER BLOCK, ...each	6/	7/	9/	12/	15/	18/	22/	27/
COUPLINGS ....pair	8/	9/	11/	14/	17/	21	25/	30/
LOOSE COLLARS.........each	2/3	2/6	2/9	3/3	3/9	4/3	5/	5/
SHAFTING, sup. qual. foot ...	1/5	1/8	2/	2/4	2/10	3/4	3/10	4/

EDWIN LUMBY AND SON,

WEST GROVE WORKS, HALIFAX,

Patentees and Manufacturers of Wrought Welded Boilers.

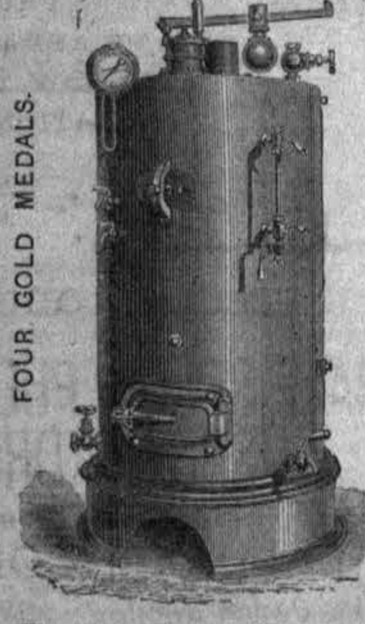
FIRE AND BURGLAR PROOF SAFES, &c

GOLD MEDAL, PARIS, 1878: SILVER MEDAL, PARIS, 1878.

THE ONLY GOLD MEDAL AT ANY INTERNATIONAL EXHIBITION FOR WELDED BOILERS.

SAFES,
STRONG ROOMS,
FIREPROOF DOORS, &c.,
For ordinary and special risks.
DEED BOXES,
CASH BOXES,
DESPATCH BOXES,
PAPER BOXES,
JEWEL BOXES,
&c., &c.

FOUR GOLD MEDALS.



Elevation. Vertical Steam Boiler.

FOUR SILVER MEDALS.

SPECIALTIES IN BOILERS.

GOLD MEDAL EXCELSIOR.
INVINCIBLE.
TRENTHAM CORNISH.
CRUCIFORM.
WITLEY COURT.
QUEEN'S.
ROYAL ALBERT.
PARAGON.
VULCAN.
TERMINAL END,
And others of acknowledged merit.
RANGE BOILERS,
RIVETTED BOILERS,
COPPER BOILERS.

GOODS SUPPLIED THROUGH THE TRADE.

LEATHER BELTING

JOHN WHITE & SONS,

BINGLEY, YORKSHIRE.

Manufacturers of Main Leather Driving Bands, Superior Machine Belting, Hard and Soft Roller Hides, Oak tanned and green picking Bands, Combing Leathers for Silk, Wool, Jute, Flax, &c., and every kind of Mechanical Leathers.

WIRE ROPES.

JOHN AND EDWIN WRIGHT,

PATENTEES, ESTABLISHED, 1770.

Manufacturers of every description OF IMPROVED

PATENT ROUND AND FLAT WIRE ROPES.

UNIVERSE WORKS, MILLWALL, POPLAR, LONDON.
UNIVERSE WORKS, GARRISON STREET, BIRMINGHAM.
CITY OFFICE—5, LEADENHALL STREET, E.C.

All communications should be forwarded to the Birmingham Address.

IRON.

The new Series commenced January 2nd, 1880.

IRON

Is an Illustrated Weekly Journal of Science, Metals and Manufactures in IRON AND STEEL.

IRON

Was established in 1823 as the "Mechanics' Magazine."

IRON

Has, therefore, been established more than half a century.

IRON

Is now conducted by PERRY F. NURSEY, C.E.

IRON

Is largely circulated on the Continents of Europe and America, and in the Colonies.

IRON.

The Circulation of this Paper will compare favourably with that of any other Journal of its class.

IRON

Is printed every Thursday evening, and published early on Friday morning.

IRON.

Communications respecting Advertisements Copies or General Business must be Addressed to the New Offices, 161, Fleet Street, London, E.C.

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Advertisements for this Paper must be sent in not Later than 6 p.m. on Thursday

THE HOWE WEIGHING MACHINES.

ADAPTED TO ALL STANDARDS.

For all Commercial, Manufacturing, Railway, Mining, and Household Uses, &c., &c., &c.

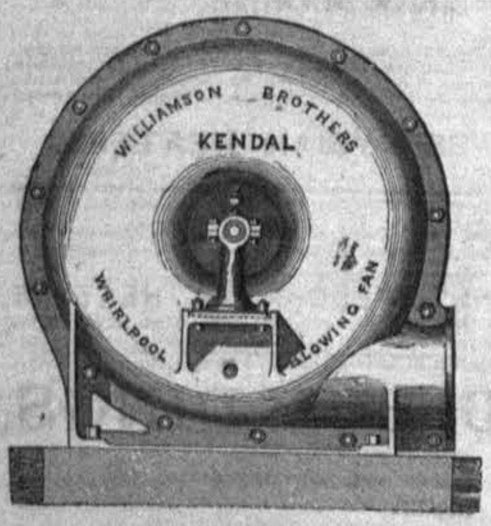
HIGHEST AWARDS AT PARIS, 1878.

OVER 600 SIZES AND STYLES, AND ALL GUARANTEED.

CATALOGUE ON APPLICATION IN ANY LANGUAGE.

FACTORY, RUTLAND, VERMONT, U.S.A.

J. FRED. DENNIS, General Manager, 8 & 9, Holborn Viaduct, London.



BLOWING FANS,

FOR CUPOLAS OR SMITHS' WORK.

These Fans are strong, well made, and require the least power to give any required blast.

CENTRIFUGAL PUMPS.

VORTEX TURBINES,

The best means of utilising water-power.

STEAM ENGINES, CORN MILL MACHINERY,

Illustrated price lists on application.

WILLIAMSON BROTHERS,

CANAL IRONWORKS,

KENDAL.

RANSOMES, SIMS AND HEAD,

ORWELL WORKS, IPSWICH, ENGLAND,

ENGINEERS AND MANUFACTURERS OF THE BEST

AGRICULTURAL MACHINERY,

ADAPTED

FOR ALL COUNTRIES, CROPS AND SOILS,

INCLUDING

PORTABLE STEAM ENGINES
EXPANSION ENGINES,
STRAW-BURNING ENGINES,
STEAM THRESHING MACHINES,
CORN SCREENS AND WINNOWERS,
SINGLE FURROW PLOUGHS,
DOUBLE FURROW PLOUGHS,
FOREIGN & COLONIAL PLOUGHS,
HORSE RAKES AND HAYMAKERS.

ILLUSTRATED CATALOGUES FREE BY POST ON APPLICATION.

London Office: 9, GRACECHURCH STREET.

GAUNTLETT'S

Patent Pyrometer or Heat Gauge.

Recent improvements have rendered this Gauge extremely sensitive and durable. It is now made to register to 1500 deg. Fahrenheit. It is applied to Ovens, Heating Stoves, Boiler Flues, Heated Air, Hot Liquid Steam, Gases, &c. Testimonials on application.

W. H. GAUNTLETT, Middlesborough-on-Tees.

URIAH NICHOLS, ENGINEER,

PERSEVERANCE IRONWORKS,

DUNCAN STREET, OLDFIELD ROAD,

(Removed from Back Quay Street),

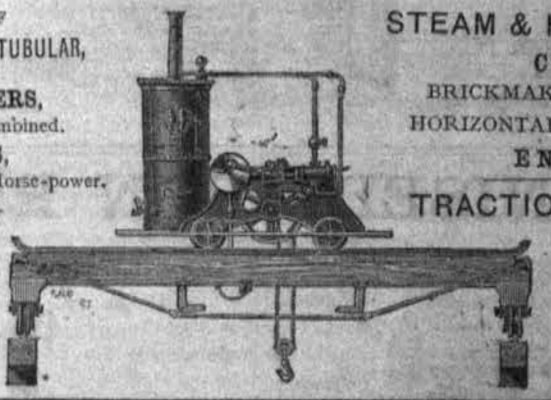
MANCHESTER.

MANUFACTURER OF
PATENT VERTICAL, MULTITUBULAR,
AND
CROSS-TUBE BOILERS,
With or without Engines combined.
MORTAR MILLS,
Fixed or Portable for Steam or Horse-power.

PILE DRIVERS,
PUMPS,
EARTH BORING
MACHINES.

STEAM & HAND CRANES,
CRABS,
BRICKMAKING MACHINES,
HORIZONTAL AND VERTICAL
ENGINES.
TRACTION ENGINES,
&c. &c.

Established 1830.



VULCANISED FIBRE,

PATENTED.

The FLEXIBLE is a Substitute for **Leather, Rubber, Gutta Percha,** &c., and is extensively used by **Plumbers, Brass Founders, Axle Makers, Hydraulic, Sanitary,** and other **Engineers Railway Companies; Carriage Builders, Pump Makers, &c.**

It makes the best insertion sheet, and for axle-washers of all kinds it is unequalled.

Mr. George Howe, Engineer at the Clay Cross Collieries, says:—

> "That a pump clack faced with Vulcanised Fibre one half inch thick, was put into work January 13th, 1879, and was taken out July 3rd, 1879, having been in work 171 days. During this time the pump made 741,827 strokes, and raised 74,182,700 gallons. The clacks were previously used with leather facings; these only lasted in work about 40 days; when faced with gutta percha, they last in work about 150 days, but gutta percha is 5s. per lb., whereas the fibre is only 2s."

The HARD is a Substitute for **Metals, Ivory, Vulcanite, Ebony,** &c., and is used for **Journal Bearings** and **Bushes, Condenser Ferrules, Railway Fish-plate Washers, Pneumatic Carriers, Electric Machines, &c.**

Mr. T. A. Edison, the great electrician, writes:—

> "I esteem it very highly, and use larger quantities of it than Vulcanised Rubber, and, in its present condition, find it very satisfactory."

Both qualities of the Vulcanised Fibre are uninjured by the action of Hot and Cold water, oils, spirits, grease, ammonia, and many other chemical agents which utterly destroy leather, metals and rubber.

Sold in sheets about 66 inches and 42 inches and varying in thickness from 1-32 to 1 inch.

SOLE AGENTS:—

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CORPORATE MARK.

Granted according to Act of Parliament, 1777 by the Cutlers' Company, Sheffield.

TOOLS, STEELS, FILES,

R. MUSHET'S SPECIAL STEEL.

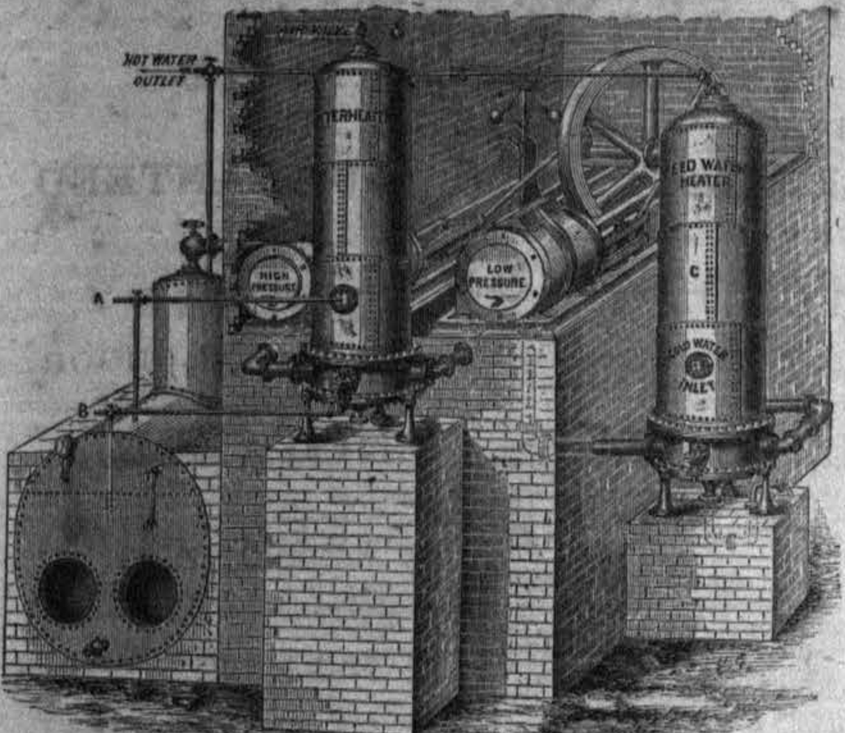
Railway Springs, Steel Castings, Shear and Spring Steel, &c., &c.

SAMUEL OSBORN AND CO.

CLYDE STEEL AND IRON WORKS, SHEFFIELD.

LONDON: 16, Philpot Lane, E.C.; BOSTON (U.S.): 10, Oliver Street;
MONTREAL: 470, St. Paul Street; BERLIN: 48, Neue Friedrichs Strasse.

JOSEPH WRIGHT AND CO., LIMITED.



Neptune Forge, Engine and Boiler Works,

TIPTON, STAFFORDSHIRE

And at 147, QUEEN VICTORIA STREET, LONDON, E.C.,
Sole Makers of Berryman's Improved Patent

UNIVERSAL EXPANDING BRASS TUBULAR HEATER,

AS APPLIED TO HIGH-PRESSURE, CONDENSING AND

COMPOUND ENGINES

LAND AND MARINE.

The great success which has attended the introduction of these Celebrated Heaters to High Pressure has led to their being applied to Condensing Engines also, and as Interheaters for Compound Engines—Stationary and Marine; and from actual experience J. W. and Co. have now reliable information as to the precise amount of Saving in Boiler Mending and Coal which can be realised by the judicious use of Exhaust steam from High Pressure, Condensing or Compound Engines with these justly

CELEBRATED BERRYMAN HEATERS.

The Interheater shown in the above sketch is fixed at any convenient distance from the Cylinders in or outside the Engine-room. The Exhaust steam from the High Pressure Cylinder is passed through the inside of the Solid-drawn Bent Brass Tubes in the Interheater, and thence into the Steam Chest of the Low Pressure Cylinders.

N.B.—The application of these Heaters to Compound Engines largely increases the effective power, especially where Engines are under their work, and they can be added to any existing plant.

AS INTERHEATERS & FEEDWATER HEATERS,

56 ARE NOW IN USE IN GREAT BRITAIN AND IRELAND EFFECTING VERY GREAT SAVING. ILLUSTRATED PRICES AND TESTIMONIALS on application to the Works.

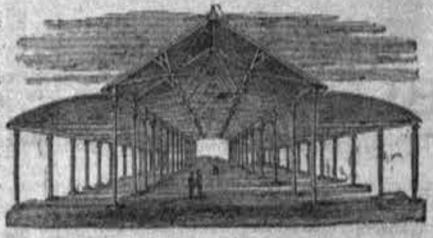
GALVANISED IRON ROOFS AND BUILDINGS.

General Store for Wharf, &c.

The system adopted by F. M. and Co., in the Construction of their Galvanised Corrugated Iron Buildings combines many advantages which no other form of building can offer. At a minimum cost they provide every required accommodation, while the construction secures great strength and durability, together with protection against fire. Illustrated Catalogues and Estimates sent on application when Purchasers should supply full particulars of requirements.

Francis Morton and Co.,

LIMITED.
ESTABLISHED OVER THIRTY YEARS.



Open Shed for Covering Large Areas.

NAYLOR STREET IRONWORKS, LIVERPOOL. LONDON OFFICE: 1, DELAHAY STREET, WESTMINSTER.

HENRY POOLEY AND SON.

PRIZE MEDALS.

London	1851
London	1862
Paris (class 53)	1867
Paris (class 63)	1867
Naples	1871
Trieste	1871
Moscow (Gold)	1872
Moscow (Silver)	1872
Brussels (do.)	1876

Manchester and Liverpool	1867
Royal	1869
Royal	1870
Manchester and Liverpool	1871
Manchester (Gold) (*Society for Promoting Scientific Industry*)	1875
Ayrshire	1876
Highland Society	1879
Royal Cornwall	1877
Royal Manchester Liverpool and North Lancashire	1878

Sole Makers of
POOLEY'S PATENT
SELF-INDICATING
and
TURNTABLE
WEIGHING MACHINES
for
PIT BANKS.

Patentees and Sole Makers of

POOLEY'S WEIGHING MACHINES,

For all Commercial, Manufacturing, Railway and Mining Uses.

ADAPTED TO THE STANDARDS OF ALL NATIONS.

WORKS:—ALBION FOUNDRY, LIVERPOOL.

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Commercial Street, NEWPORT, MON.
Fennel Street, MANCHESTER.
Siddals Road, DERBY.
41, Hope Street, GLASGOW.

Sole Makers of
POOLEY'S PATENT
TRAMWAY
WEIGHBRIDGES
and
Improved Indicators
for
BILLY FAIRPLAY
MACHINES.

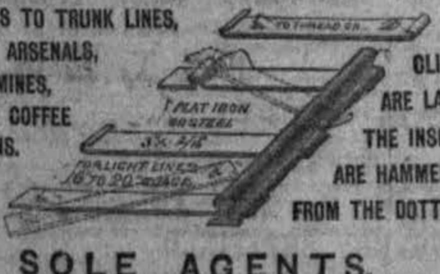
A NARROW GAUGE RAILWAY

—LEGRAND'S PATENT—

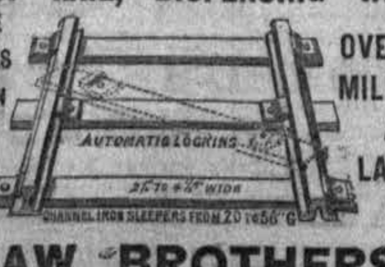
COMPLETE IN TWO PARTS, From £250 per Mile.

WROUGHT IRON SLEEPERS TO FIT ANY RAIL, DISPENSING WITH SPIKES AND ALL LOOSE PIECES.

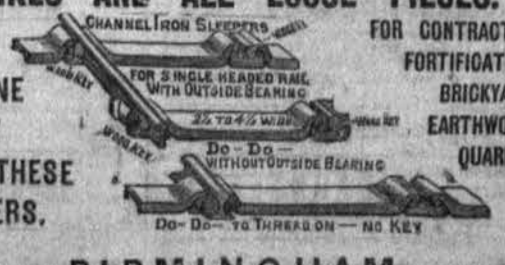
FOR FEEDERS TO TRUNK LINES,
QUAYSIDES, ARSENALS,
FORESTS, MINES,
SUGAR AND COFFEE
PLANTATIONS.



THE OUTSIDE
CLIPPING SLEEPERS
ARE LAID FIRST, THEN
THE INSIDE SLEEPERS
ARE HAMMERED UP AS
FROM THE DOTTED LINES.



OVER 1000
MILES OF LINE
ARE NOW
LAID WITH THESE
SLEEPERS.


CHANNEL IRON SLEEPERS
WOOD KEY
FOR SINGLE HEADED RAIL WITH OUTSIDE BEARING
2½ TO 4½ WIDE
Do - Do - WITHOUT OUTSIDE BEARING
Do- Do- TO THREAD ON — NO KEY

FOR CONTRACTORS,
FORTIFICATIONS,
BRICKYARDS,
EARTHWORKS,
QUARRIES.

SOLE AGENTS, **SHAW BROTHERS,** BIRMINGHAM.

DRAWINGS & PARTICULARS ON APPLICATION. TO SAVE TIME, PLEASE GIVE GAUGE, WEIGHT OF RAIL AND KIND OF TRAFFIC.

TWO SILVER MEDALS, PARIS, 1878.
THE CHILIAN MEDAL, SANTIAGO, 1875.

THE GLENBOIG STAR FIREBRICK WORKS,

NEAR COATBRIDGE, N.B.

JAS. DUNNACHIE,
2, *West Regent Street, Glasgow.*

CONTRACTOR TO HER MAJESTY'S GOVERNMENT

Manufacturer of Fire Bricks for Steel, Iron, Brass, Gas, Chemical and Glass Furnaces, Copper roasting, calcining and refining furnaces. The special bricks for the Siemens regenerative gas-furnace (this is the brand recommended by Dr. C. W. Siemens), Bessemer tuyeres, runners, plugs and stoppers. Gorman tubes. Gannister of highest quality, ground fireclay. No other firebrick combines such a high degree of infusibility with the perfect absence of cracking and splitting up under sudden cooling.

Each brick bears the registered Trade Mark,

TRADE J STAR WORKS ✱ GLENBOIG D MARK

Quotations, Illustrated Catalogues, &c., on application.

Shipping ports, Glasgow, Grangemouth, Leith, Granton, Bonness, &c.

London Agents: Messrs. Doulton and Co., Lambeth Pottery, and Crown Wharf, Victoria Park, E.

Wheatley Kirk, Price and GOULTY. ESTABLISHED 1850.
MECHANICAL VALUERS, AUCTIONEERS AND ARBITRATORS.
Head Offices—Albert Square, Manchester.

Partnerships. — Gentlemen (Practical Engineers) desirous of entering established Engineering concerns, are invited to communicate with the undersigned, who have numerous bona fide establishments open to admit such. References are given and required.—WHEATLEY KIRK, PRICE AND GOULTY, Albert Square, Manchester.

Engineering Firms of Good REPUTE, open to admit partners, or desirous of selling outright, are requested to communicate with the undersigned, who have numerous clients open for such.—WHEATLEY KIRK, PRICE AND GOULTY, Albert Square, Manchester.

IN THE HIGH COURT OF JUSTICE, CHANCERY DIVISION.

IN THE MATTER OF THE COMPANIES ACT 1862 AND 1867.
AND
IN THE MATTER OF JACKSON, GILL AND Co. (LIMITED.)

To be Sold, pursuant to an Order of the High Court of Justice, made in this Liquidation, with the approbation of the Master of the Rolls, by Mr. Charles Willman, C.E., M.E., the person appointed by the said Judge, at the Board Room, Royal Exchange, Middlesbro', in the County of York, on TUESDAY, the 23rd day of March, 1880, at 12 o'clock at noon precisely, in one Lot, certain FREEHOLD IRON WORKS, known as the "Imperial Iron Works," situate at South Bank, near Middlesbro'-on-Tees, in the County of York, together with the Land, Fixed Plant, Buildings, Railways, Loose Plant and Tools, Brick Works, and also 20 Freehold Cottages occupied by Workmen employed at the said Ironworks. The Works are at present in full operation, and will be offered for sale as a going concern.

Particulars and conditions of sale may be obtained gratis of the Liquidator, Mr. W. B. Peat, Royal Exchange, Middlesbro'; at the office of R. Mackay and Co., 3, Lothbury, London; at the Works; of the Auctioneer, at his Offices, Middlesbro'; of Messrs. Van, Sandan, and Cumming, 13, King Street, Cheapside, London; and of Messrs. Jno. T. Belk and Parrington, Solicitors to the Liquidator, Post Office Chambers, Middlesbrough.

Dated this 2nd day of March, 1880.

JOHN W. M. HAWKINS,
Chief Clerk.

Van Sandan and Cumming,
13, King Street, Cheapside, London.
Agents for John T. Belk and Parrington,
Middlesborough, Yorkshire,
Solicitors for the Liquidator.

To be Sold, the Well-Constructed IRONWORKS, situate on the banks of the Western Canal of the Weaver Navigation, in the township of Clifton, in the county of Chester, together with the Chimney Shaft, 20 Puddling and Re-heating Furnaces, Seven Plate, Sheet, and Bar Rolling Mills, Fitting and Pattern Shops, Smiths' Shop, Moulding Shop, Laboratory and Offices, Grinding Shed, Drying House, &c. Also the Plant, &c., thereon, comprising vertical steam engines with shafting, gearing, and pulleys complete; drilling machine, grinding machine, disintegrators with hoppers, shafts, pulleys, elevators, &c.; cranes, rolling mills, steam hammers, shears, punching machines, circular saw, steam winch, steam travelling crane, weighing machines, Pooley's patent; mortar mill, with all the requisite appliances for carrying on the manufacture of iron. The works are conveniently situate for the manufacture of iron from purple ore, there being an abundance of that article in the district. The St. Helens and other coal fields are near, and connected by canal and railway. Distance from Runcorn two miles, from Liverpool 18 miles. The site of the works comprises 5a. 2r. 22p. and (with the exception of a small slip of freehold to the west of the works) is held under a lease for a term of 999 years, from the 25th March, 1876, subject to an annual ground rent.—A plan of the site of the works and printed particulars of the plant may be had and further information and orders to inspect obtained on application to Messrs. Harmood Banner and Son, 24, North John Street, Liverpool; or to Messrs. Bateson and Co., solicitors, Liverpool.

Locomotive Tank Engines of all sizes and for all gauges. Several in stock and in progress.—FLETCHER, JENNINGS and Co., Lowca Engine Works, Whitehaven.

---

200 TONS NUTS, BOLTS, &c.,

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LONDON ROAD, MANCHESTER.

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THE NEW PATENT FLINT FURNACE BRICKS.

Salwey and Co. having obtained Letters Patent for the protection of this VALUABLE INVENTION, which produces bricks of a far superior quality to all Dinas and other fire bricks, are now anxious to test them on a commercial scale. They are now prepared to supply a sufficient number of bricks gratis to firms selected from those who may apply, to erect a furnace on a sufficient scale to test the value of the Patent, provided that a reliable report will be guaranteed. By this invention a brick is produced from flints (which consist of pure Silica) with as much textile cohesion as a fire-clay brick, and with greater refractory power than any Dinas or other Silica Brick.—See "IRON," page 655, 23rd Nov., 1878.—Apply to E. R. SALWEY, Bryngarw, Bridgend, South Wales.

IN LIQUIDATION.

To be Sold by Private TREATY, as a going concern, on the Great Northern Line of Railway, a well-established ENGINEERING BUSINESS, comprising the following branches, viz:—

The Manufacture of Stationary Engines and Boilers.

Portable and Combined do.

Agricultural Implements of all classes,

And especially the Manufacture of Wrought Iron Cranks, for which a complete Plant of Patent Machinery has been put down; also General Iron Founding with all the Appliances for carrying on and extending a first-class trade.

The Machinery and Tools are by well-known makers, and the new Buildings are erected upon land secured on a 999 years' lease.

Full particulars can be obtained from Mr. Isaac Jenks, of Wolverhampton; Mr. Thomas Leman, Accountant, Nottingham; or Messrs. Corser, Fowler and Langley, Solicitors, Wolverhampton.

BELFAST AND COUNTY DOWN RAILWAY.
OLD RAILS.

The Directors of this Company are prepared to receive TENDERS for about 100 tons of OLD BRIDGE and FLANGE RAILS at per ton of 2240 lbs. Delivery to be taken on the Company's premises, Belfast.

Terms cash.

The Directors do not bind themselves to accept the highest or any Tender.

Tenders to be lodged with the Secretary on or before the 23rd inst,

By order,
JOHN MILLIKEN,
Secretary.

Belfast, 5th March, 1880.

WINDSOR IRONWORKS, NEAR EDGE HILL STATION, LIVERPOOL.

To be Let part of these PREMISES, viz., one building 420 feet long by 87 feet wide, 29 feet high. One building 105 feet long by 54 feet wide, 18 feet high, two storeys, and one 106 feet long by 24 feet wide, 42 feet high, three storeys and cellar, suitable for any purpose; will be subdivided if necessary. Rents very moderate, immediate possession.—Apply to ISAAC DIXON, at the premises.

BLAST-FURNACES FOR SALE BY PRIVATE TREATY.

The Liquidator is prepared to treat for the SALE of the SOUTH DURHAM IRONWORKS, situated at Darlington, in the county of Durham, consisting of three Blast-Furnaces, with 13 acres of freehold land, and loose Plant and Tools thereat.

Further information and particulars and authority to inspect the works may be obtained on application at the offices of R. Mackay and Co., 3, Lothbury, London, E.C., and the Royal Exchange, Middlesborough; or to Messrs. DODDS and Co., Solicitors, Stockton-on-Tees.

Houses in the Machinery Line, including Ice, Soda, Electro Plate, Gas, Tea, Oil, Wood and Iron Working Machines, Engines, also Oilmans Stores, Hardware and Cutlery, will please send priced and Illustrated Circulars to Messrs. JAMES SAUNDERS and Co., Wholesale Importers, Benares, India.

Waterside Premises.—WAREHOUSES to LET with or without frontage to River Thames, in portions to suit applicants.—Apply, 4, Upper Thames Street, London, opposite "Times" Office.

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Two Small Locomotive ENGINES FOR SALE, suitable for Light Railways, Ironworks, or Contractors' purposes. Four wheels 2 feet 6 inches in diameter, 8-inch cylinder. Price, loaded in trucks at Lydney Station, £450 each. Apply to the FOREMAN, Locomotive Sheds, Lydney Station.

To be Sold, an Ironworks, in Germany, fully at work, manufacturing B.B. puddled iron rods and Bessemer steel for wire.—For information apply to Messrs. WILLIAM GRUNDY and SON, auctioneers and valuers, 54, John Dalton Street, Manchester.

For Sale.—4 Second-hand BOILERS and a few Tons WROUGHT and CAST IRON SCRAP.—Apply to Cork Carpet Works, Sugar House Lane, Stratford, E.

Advertiser can recommend a YOUNG MAN aged 20, as PORTER or ASSISTANT in Warehouse. Has been used to Horses.—Address, "P. A. K.," IRON Office, 161, Fleet Street.

BY ORDER OF THE SECRETARY OF STATE FOR INDIA IN COUNCIL.

FOR INDIAN STATE RAILWAYS.

The Director-General of STORES FOR INDIA is prepared to receive TENDERS from such persons as may be willing to SUPPLY.

Contract No. 1. WROUGHT IRON PIERS for the Bridge over the Indus at Attock.

Contract No. 2. COUPLING HOOKS, &c.

The Conditions of the Contracts may be obtained and the Drawings inspected on application to the Director-General of Stores, India Office, Westminster, S.W., and Tenders are to be left at his Office at any time before Two o'clock p.m. on WEDNESDAY, 31st March, 1880, after which no Tender will be received.

A. ABERCROMBIE JOPP,
Director-General of Stores.

India Office, 16th March, 1880.

To Landed Proprietors, Manufacturers, Farmers, &c.—Important and very Extensive Sale of IRON ROOFS, IRON BUILDINGS, GALVANISED IRON ROOFING SHEETS, IRON HURDLES, WIRE FENCING, GATES, TANKS, and other Iron Goods, at Angela Street, Edge Hill.

Mr. Costigan has been favoured with instructions from Messrs. P. Deuchar and Co., Iron and Steel Merchants, to SELL by AUCTION, without reserve, on TUESDAY and WEDNESDAY, the 23rd and 24th instant, at 11 o'clock, in Angela Street, Edge Hill, Liverpool, about 122 TONS of Valuable Iron Goods of first-class make, well finished, and in every respect of unexceptionable quality, comprising, 38 complete galvanised corrugated IRON ROOFS, 2 IRON BUILDINGS, 20 feet by 15 feet, 2 ditto, 16 feet by 10 feet, 11,000 galvanised corrugated IRON ROOFING SHEETS, 200 IRON HURDLES, 2000 Yards of strong WIRE FENCING, 850 plain IRON SHEETS, 380 wire Fencing Standards, 3400 feet Iron Gutters, 2800 feet rain water Pipes, 420 painted corrugated Iron Sheets, and a large assortment of Wire Rope for fencing, Straining Blocks, Wire Staples, Iron Troughs, Gates, Rain Gutters and Pipes, Iron Ridging, Asphaltic Roofing Felt, Hair Felt for covering boilers, Gutter Hold-fasts, Screw-bolts, Wood-screws, round-head Nails and Rivets, Burrs, Cast Steel, Iron Paint, Iron Columns, a quantity of useful Timber, comprising Deals, Scantlings, Boards, and numerous other articles. The corrugated Iron Roofs &c., are worth the careful attention of Agriculturists and Manufacturers in want of strong, durable, and cheap fire-proof Coverings. The goods may be viewed two days before Sale, and Catalogues had from Mr. Costigan, Auctioneer, Park Road, Liverpool; or Messrs. P. Deuchar and Co., 22, North John Street, Liverpool, from whom also further particulars may be obtained.

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A Valuable Quarry, well proved and tested, held at a small royalty can be treated for either as a whole or as a company.—Particulars of Mr. SMITH, Wynnstay Hotel, Ruthin, North Wales.

Copper Pan, Steam-jacketed, WANTED, with Valves, Cock, Pipes, &c., complete; diameter, 6 to 8 feet, depth from 20 to 30 inches; second-hand or new.—Apply, stating full particulars and price, to W. and C. VOLCKMAN, High Street, Stratford, E.

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Gentleman representing a Swedish house, and having first-class connection amongst Wire Manufacturers, Nail Makers, Iron Merchants, Shippers, and others throughout the country, would be glad to represent another good firm.—Address "WIRE," W. H. Smith and Son, 33, Union Street, Birmingham.

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Tenders will be received until Two o'clock on the 30th day of March for

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- WEIGHING MACHINES.

Manufacturers only will be accepted.

Forms of Tender, containing conditions of Contract and all particulars, may be obtained on personal application at this office, or by letter addressed—"Director of Navy Contracts, Admiralty, Whitehall, S.W."

Patterns of all the articles may be seen at the Admiralty Pattern Rooms, 19, Hemming's Row, Trafalgar Square, W.C., and at the Royal Small Arms Factory, Bagot Street, Birmingham, on application to Mr. F. T. Edwards, from whom Forms of Tender for all the goods may also be obtained.

JOHN COLLETT,
Director of Navy Contracts,
Contract Department,
Admiralty, Whitehall,
18th March 1880.

IRON CASKS AND CANS.

Tenders will be received until Two o'clock on the 6th day of April for Supplying IRON CASKS AND CANS, under a 3 years' Contract. Manufacturers only will be accepted.

Forms of Tender, containing conditions of Contract and all particulars, may be obtained on personal application at this Office, or by letter addressed—"Director of Navy Contracts, Admiralty, Whitehall, S.W."

Patterns of all the Articles may be seen at the Admiralty Pattern Rooms, 19, Hemming's Row, Trafalgar Square, W.C., and at the Royal Small Arms Factory, Bagot Street, Birmingham, on application to Mr. F. T. Edwards, from whom Forms of Tender for all the goods may also be obtained.

JOHN COLLETT,
Director of Navy Contracts.
Contract Department,
Admiralty, Whitehall.
18th March, 1880.

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Patents.—"Patent Law in PLAIN ENGLISH." By W. P. THOMPSON, C.E. 1878 Edition. British portion, 6d.; all countries, 2s. 6d.
Published by W. P. THOMPSON and Co., Patent Solicitors and Negotiators for the Sale of Patents in all countries, 323, High Holborn, London, and 6, Lord Street, Liverpool. "It is the handiest synopsis of the subject we have seen, and we commend it to the notice of every intending patentee."—IRON.

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Society of Engineers.—The THIRD ORDINARY MEETING of this Society for the year 1880 will be held on MONDAY, the 5th of April, in the Society's Hall, 6, Westminster Chambers, Victoria Street.
A paper on "Distilling and Hoisting Machinery in Sea-going Vessels," by Mr. H. W. PENDRED, will be read and discussed.
The Chair will be taken at half-past seven o'clock.
ALFRED ELGAR, Secretary.
6, Westminster Chambers, S.W.

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Have always on hand a large Stock of **ROLLED MALLEABLE IRON JOISTS and GIRDERS** of all sizes up to 20 Inches deep and assorted lengths; also, all other descriptions of **Iron for Engineers, Boiler Makers, Shipbuilders, &c., in Bars, Plates, Bulb Iron, Angles, Tees, Jackstay Channel, Hoops, Sheets, Rods, &c. Iron and Brass Boiler Tubes.**
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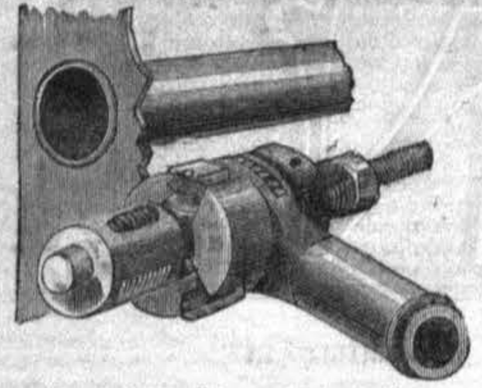

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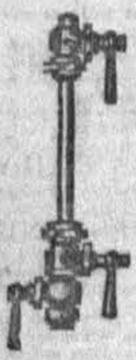

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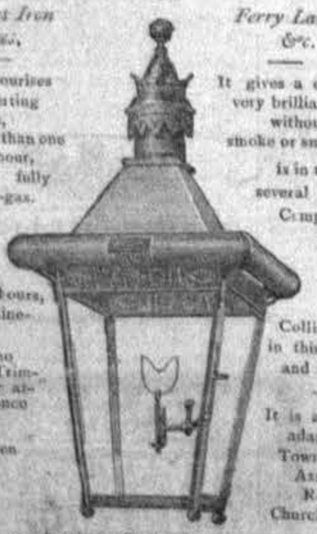
PATENT GAS-OIL LAMP,

For Lighting Towns, Railway Stations, Ironworks, Collieries Iron Mines, Ferry Landings, &c.



The Burner vapourises the Oil, converting it into Gas, at a cost of less than one farthing per hour, giving a light fully equal to coal-gas.

One supply of Gas Oil will burn about 45 hours, a cost of ninepence.

No Wick; no Chimney; no Trimming; no further attention after once lighting.

Contracts taken for Public Lighting.

It gives a clear and very brilliant light without smoke or smell, and is in use by several Railway Companies, Iron and Steel Works, and Collieries, &c., in this country and abroad.

It is also being adapted for Town Halls, Assembly Rooms, Churches, &c.

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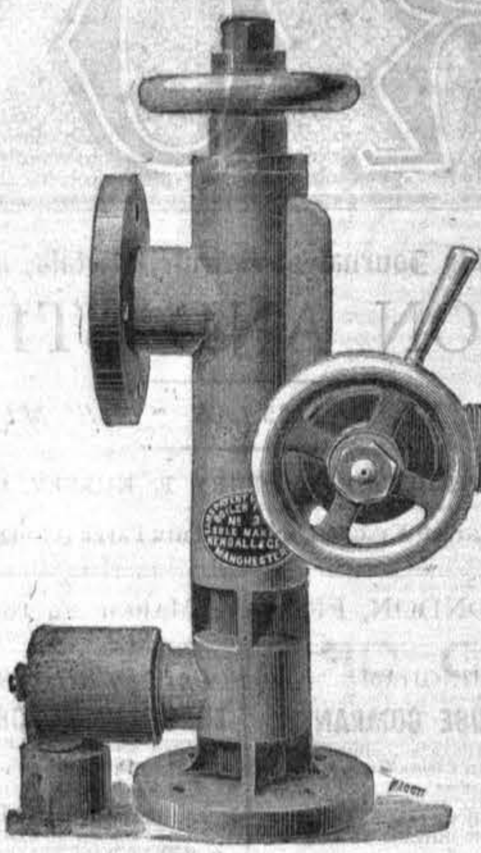
DOUBLE-ACTION BOILER FEEDER,



Is much less costly than a Donkey Pump, and equally reliable.

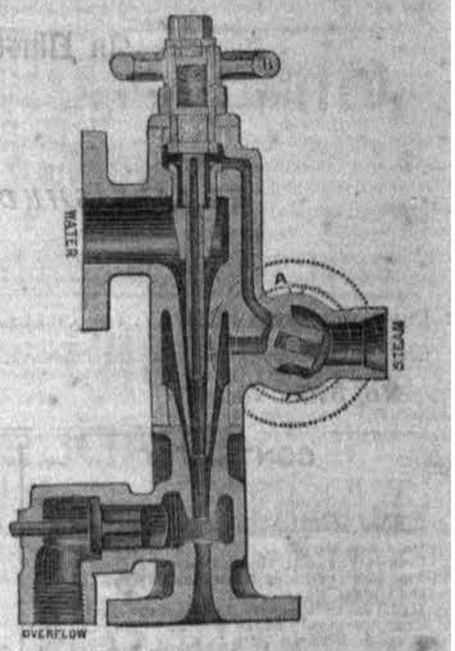
Will work with various variable steam pressure, and with water supply at a high temperature.

Admits of the feed being regulated according to requirements.

Has no stuffing boxes or joints entailing constant renewal of packings.

Can be examined internally throughout without removal or disconnection of a single joint.

So simple and easy to work that any unskilled person can put it in operation; indeed, in this respect, as well as certainty to continue in action without further attention until stopped, it is unequalled.



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ESTABLISHED 1860
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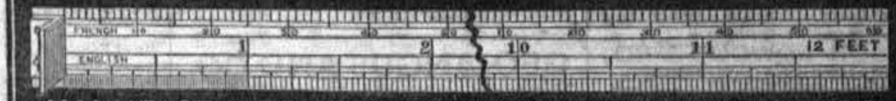

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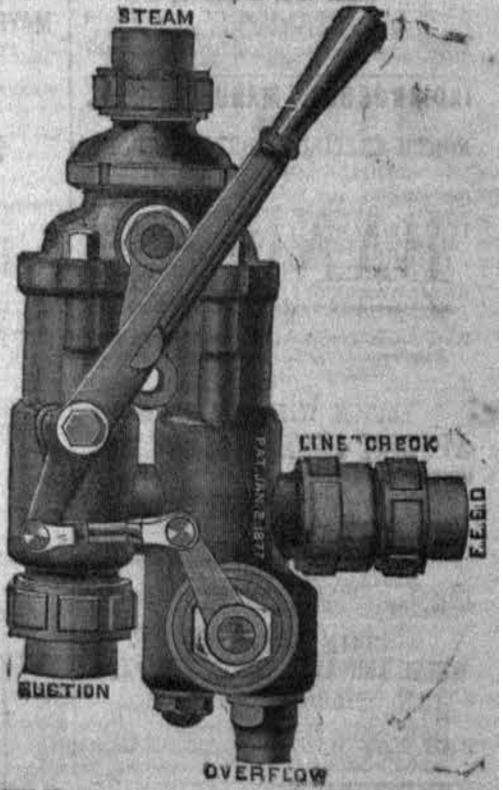

Eclipses all other appliances hitherto introduced for feeding Steam Boilers.

Traction and Portable Engines are not perfect without them. It lifts its water 25 feet with a low steam pressure, and puts it directly into the Boiler. No adjustment necessary for varying steam-pressures.

Invaluable on board large Steamers, Steam Launches, Tug Boats, &c.

No sudden jolt, nor the rolling and pitching of a vessel, will stop its action. As all other objectionable features in the ordinary form of Injectors are hereby overcome, it is an economical combination at once simple, and of guaranteed efficiency.

Full Particulars and Price Lists sent on application to the

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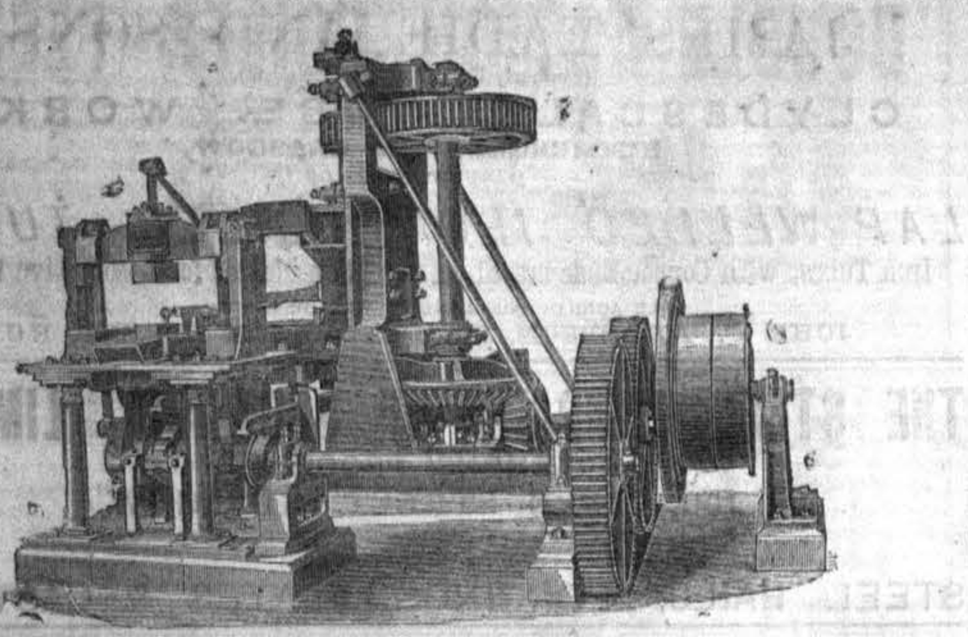
CRAVEN'S PATENT BRICK MACHINE.



The above Machine, recently introduced, is the result of 30 years' experience in manufacturing Machinery of this class. By its action the clay is first pugged, then moulded under considerable pressure, and on delivery from the mould table the bricks are again powerfully pressed before removal, when they are ready for placing direct in the kiln, thus embracing all the advantages of the semi-dry making, and at the same time the quality produced is that of the best plastic made and pressed brick.

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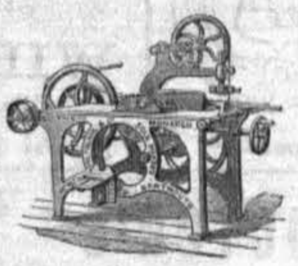

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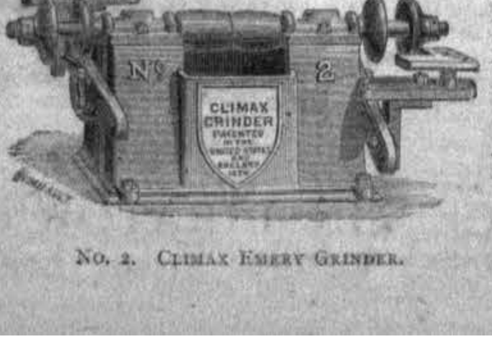

No. 2. Climax Emery Grinder.

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MILL BAND & HOSE PIPE BUTTS.

Indiarubber Hose, &c.

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PRICE £4 10s. 0d.

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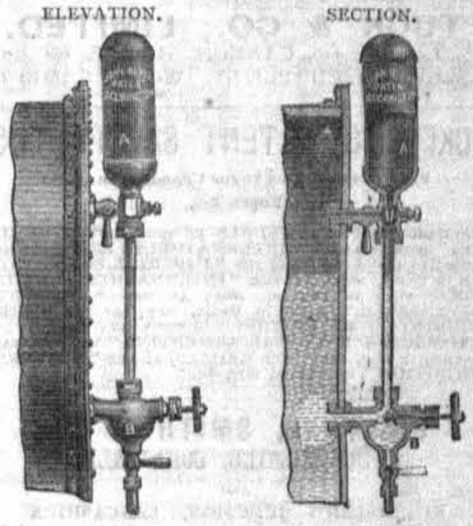

A is a cylindrical copper vessel supplied with steam through the top gauge cock, and being exposed to the atmosphere it is constantly condensing the steam, thus causing a downward flow of clean water into the glass tube and bottom gauge cock, and so excluding dirt or sediment which would otherwise enter from dirty water in the boiler. When the blow-off tap is opened the clean water is ejected, and on closing it any dirt or sediment that may have entered whilst blowing through settles in the dirt box, B, which dirt is immediately discharged the next time the blow-off top is opened.

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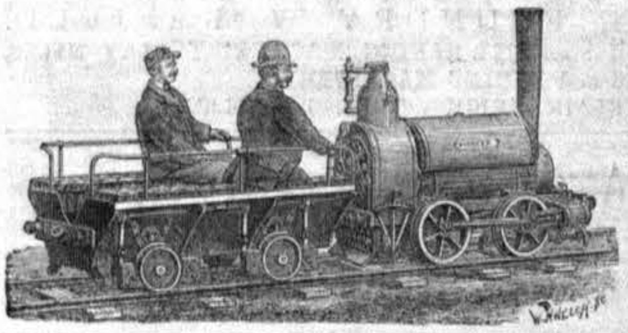

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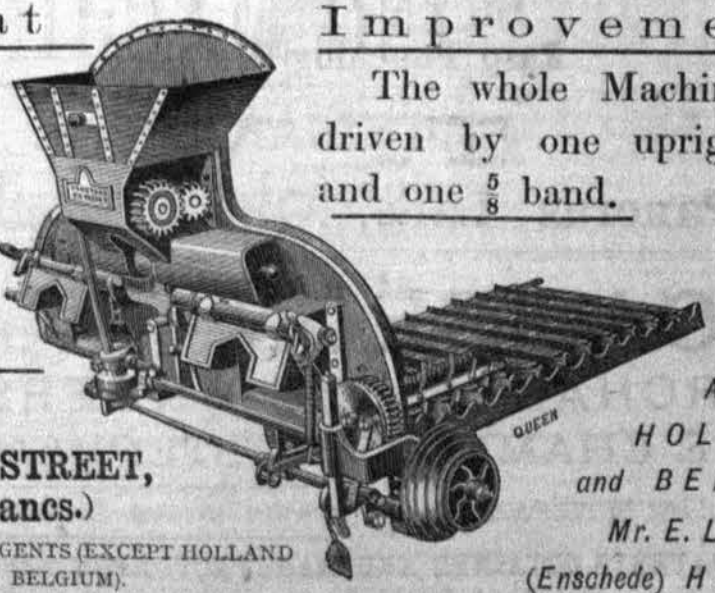

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MAKES BOLTS
WITH
SQUARE, HEXAGON OR CHEESE HEADS,
AND WITH
SQUARE OR ROUND NECKS.
WHICH DO NOT REQUIRE
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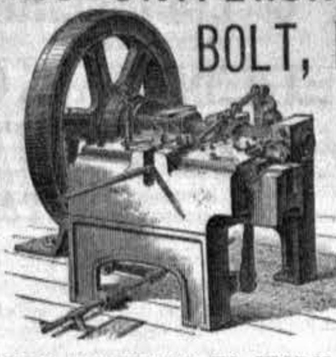
OVER 60 OF THESE MACHINES HAVE BEEN SUPPLIED TO BOLT AND NUT MANUFACTURERS, ENGINEERS, &c.

MADE IN THREE SIZES, TO MAKE FROM THREE-EIGHT INCH TO ONE AND A HALF INCHES DIAMETER, ANY LENGTH.



MAKES NUTS,
SQUARE OR HEXAGON,
WITHOUT
ANY LOSS IN PUNCHING,
AND DOES NOT REQUIRE
DRESSING OR FINISHING BY HAND.

TO SEE MACHINES WORKING,
APPLY TO
SAMUEL MARSDEN AND SON,
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NO SKILLED LABOUR REQUIRED TO WORK THESE MACHINES.

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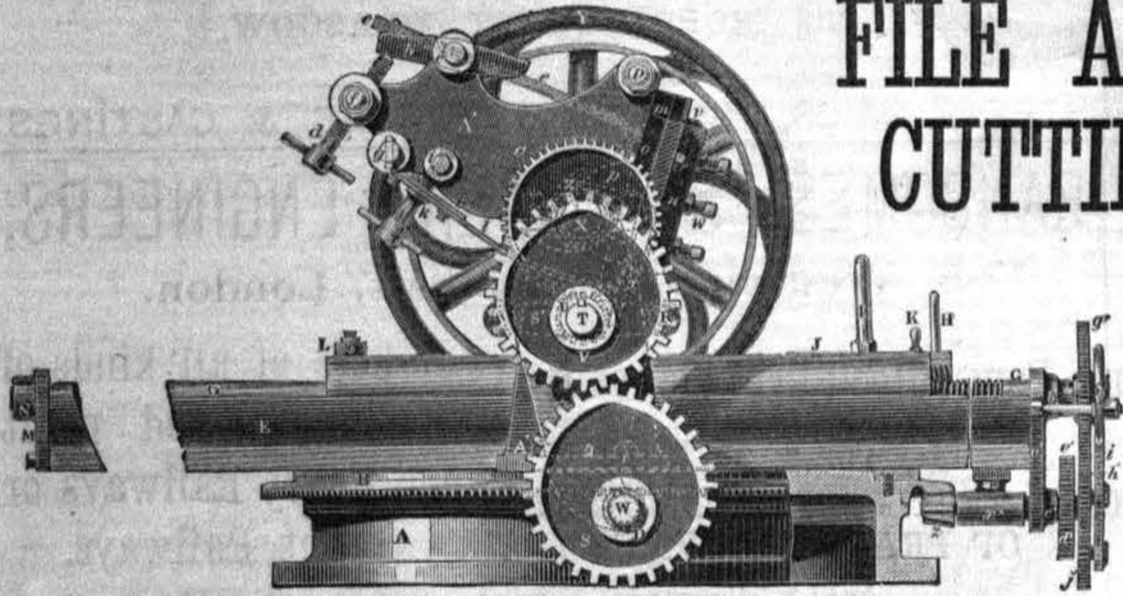
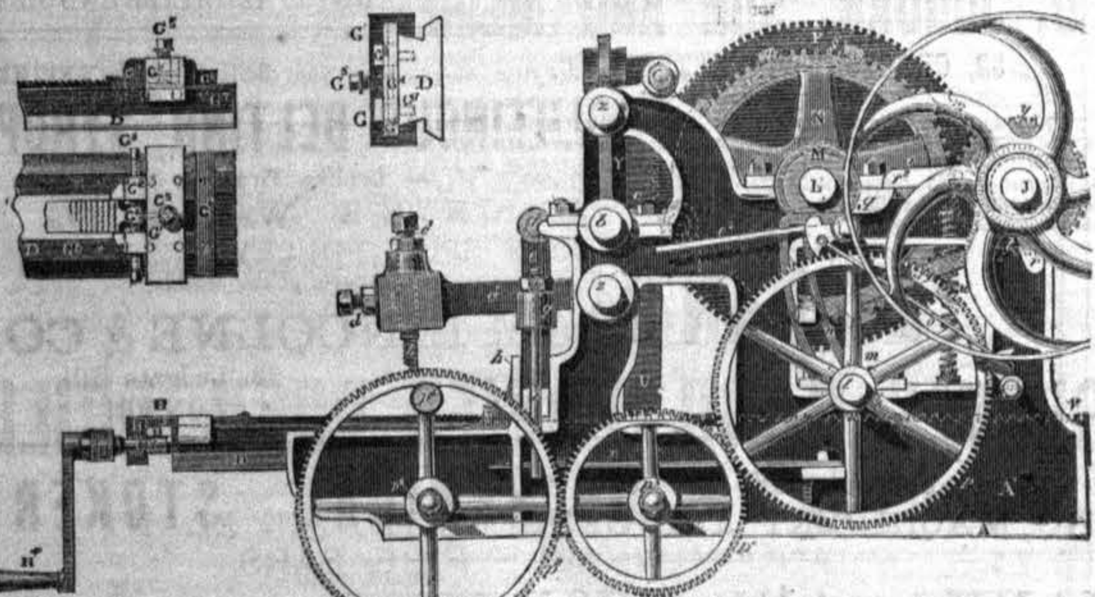


File Cutting Machine.



Rasp Punching Machine.

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PATENT RIGHTS
OF THESE
MACHINES,
Taken out in January, 1878,
are now offered.

FOR FULL
Illustrated Description,
see "IRON,"
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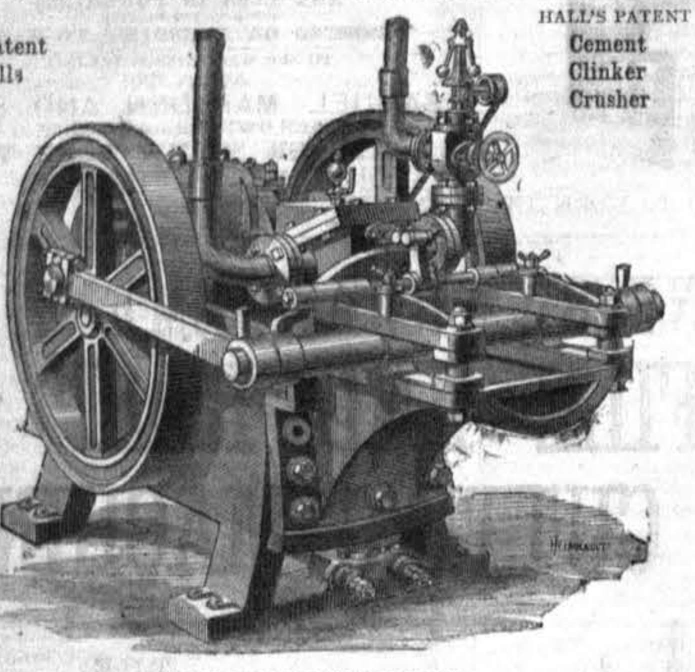
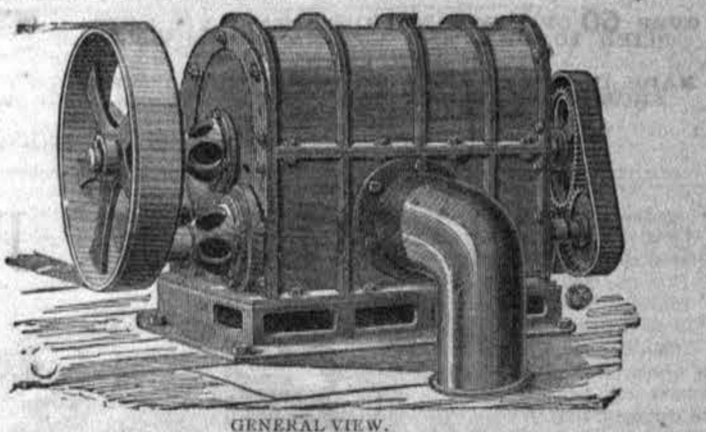


ENGINE AND MACHINE COMBINED.



GENERAL VIEW.

This Blower is adapted for Cupolas, Smiths' Fires, Ore Hearths, Slag Hearths, Refineries, &c., &c., also for Ventilating Coal and other Mines, Ships, Buildings, Railway Tunnels, Drying Rooms, and generally for elevating Grain, Timber, Sugar, &c.

ITS ADVANTAGES ARE

Fewness of parts—Less pulsation than any of its class—Capability of running direct from an Engine—Not being affected internally by wearing of gears—Requiring no lubrication internally, and no dubbing to make it temporarily tight—Exhausting as well as blowing—Non-injury from dust—Steady running, without jerking belts—Unchangeability in power from damp—Blowing hot and cold equally well—Small power required for amount of air discharged—And entire absence of friction internally.

QUARRYING MACHINE.

Hand Power Rock Drill Company, Ltd.

TUNNELLING MACHINE

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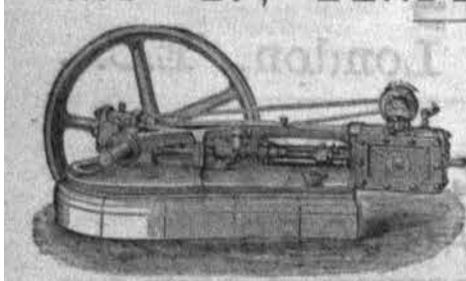
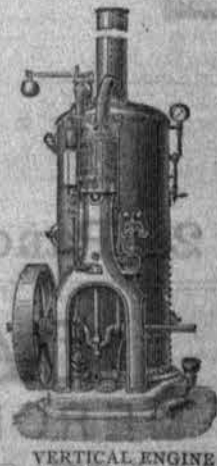


THE CALEDONIAN.



VERTICAL ENGINE AND BOILER.

Horizontal and Vertical Engines and Boilers, Steam Cranes, Hoisting Engines, Deck Winches, &c., can be seen on application at 27, Leadenhall Street. Price List and full particulars sent free.

WHEATLEY KIRK, PRICE AND GOULTY, ENGINEERS, ALBERT SQUARE, MANCHESTER,
SOLE AGENTS FOR MANCHESTER AND DISTRICT.

IRON.

LONDON, FRIDAY, MARCH 26, 1880.

AMERICAN PROTECTION.

IN our previous articles on the subject of American protection, we have shown the effects of the artificial perversion of capital on the American iron trade itself, and also how the high price of iron has nipped in the bud an important American industry, which once promised to be especially flourishing, viz., that of shipbuilding. Our contemporary the *American Manufacturer*, still continues to misinterpret our statements. Recently, he quotes our report on the inability of the Furness and Cumberland district to supply the present increased demand for hematite, and adds that we have attempted "to prove that the iron trade in England is not troubled with scarcity of labour." We have attempted nothing of the kind; but have distinctly stated our own difficulties, and have no object in concealing them, seeing that we have no artificial interferences to bolster up, or legislative "ring" to sustain. When we state that "the depressed times through which we recently passed had the effect of causing a large number of miners to emigrate," we simply illustrate by our own experience what we maintain is operating on a scale of ruinously greater magnitude in the United States. If men are tempted to leave Cumberland, or any other part of England, to go to the Far West, how much greater must be the temptation to those who have the tempting allotments offered to them close at home? Where we lose a small percentage of our men during periods of depression, the American ironmaster is visited by a wholesale exodus. The existence of our small trouble simply proves the inevitable character of the greater one afflicting the American ironmaster.

Those supplies of Spanish hematite to which our contemporary refers, are very instructive, as affording another instance (similar to the case of the Cleveland ores which we have already discussed) of the disastrous effects of protection in crippling the natural development of American industry. Had the capital now forcibly perverted to the erection of forge mills, &c., in feeble mimicry of British enterprise, been allowed, by the operation of free trade, to flow into its natural channels, the boundless mineral wealth of the Lake Superior, the Iron Mountain and Pilot Knob of Missouri, and other hematite districts of the States, would have been fully developed, and the ores exported in steadily growing quantities to this country. Instead of this, we have been so poorly supplied with this rich raw material, that British capital and British energy and industry have set up a rival at Bilbao, which the owners of American ores will find themselves unable to compete with. Had we been steadily and abundantly supplied, as assuredly we might have been, with these American hematites, Mr. Wm. Bragge would not have had the motive to journey from Sheffield to Spain to negociate for lease of the Spanish mines; the large amounts of British capital would not have been invested in the dangerous region where the Carlist civil war was raging; the railways from the mines to the coast would not have been made by Englishmen, nor the mines opened, nor steamers chartered, nor would Sir John Brown be now receiving his royalties on their product, but for the scarcity induced by lack of American enterprise. Now that this heavy outlay has been made, the shareholders of the Bilbao mines who have so long been looking in vain for dividends (and are quietly determined to know the reason why they are not forthcoming) will not release their grip on the enterprise, nor allow the Americans to beat them in the British market. Spanish ores, having got the start at the cost of so much outlay and risk of capital, will assuredly keep the lead, for now the special railway carries them to Bilbao, and the sea journey across the Bay of Biscay is shorter than that across the Atlantic. The case would have been very different had the natural laws of supply and demand been allowed to operate freely. In such case it would have proved cheaper and easier to obtain British finished iron in exchange for the super-abundant American raw material than to make the iron in America, though, as we have already said, this state of things would not last for ever, for as the population of the States becomes more dense the relations between the supply of raw material and the supply of labour will alter. The time may arrive when all the raw material of the great American continent will be used there—when neither raw cotton, nor iron ores, nor corn, nor wheat, nor Cove oysters, nor beef, nor any other manufacturing nor food material, will cross the Atlantic. But when will that be? In what order will the cessation of export occur? Will cotton, or corn, or minerals, or fish, or flesh, or prairie hens, or what else, be first exhausted by the home demand?

No statesman can answer these questions, but they will all answer themselves if commerce is not enslaved. Demand will regulate prices, and immediately home manufacturers or home consumers can pay more than the foreigner, the exportation of raw materials will cease; and in like manner immediately the American workmen and capitalists are able to produce any manufactured article at a price equal to that of the foreign production, *plus* the cost of importation, those imports will cease. This will occur exactly at the proper time, precisely when it should occur, not one day too soon nor one day too late, and all without the aid of meddling legislators or charlatan politicians of any kind. It is melancholy to contemplate the inability of English-speaking men to understand these simple undeniable principles, to find them blindly blocking the progress of their own civilisation and prosperity by clinging to practices that every educated Anglo-Saxon on this side has long since learned to regard as merely the relics of an effete barbarism.

The phenomenal character of these delusions is the more remarkable when we find that they are warmly supported by their worst victims, by the bulk of American citizens who are so heavily taxed to support the hothouse industries that in this generation are incapable or maintaining themselves on their own merits. If a poll tax were levied of one dollar per annum in hard cash on every citizen of the United States, and if the amounts thus raised were simply and directly divided in the shape of hard cash among the people engaged in the various protected industries of the States, there would—to borrow the language of Artemus Ward—"be a fite"; but when the tax is levied in the form of double prices for the clothes he wears, the machinery and implements with which he tills the ground, the rails upon which he travels, and, in short, upon everything but bare food, and fuel and timber, *i.e.*, upon all the higher demands of civilisation and refinement upon everything but the animal necessities, everything beyond what man requires in common with the pig, the American citizen submits, and even exults in, the cruel exaction and all its degrading consequences. Visitors from the Old World, whatever be their nationality, are astonished at the shabby clothing and want of the physical appliances of refinement and elegance which prevail among the masses of the American people, when compared with Old World people receiving corresponding wages. He is at first apt to suppose that it arises from a want of intelligence, or of natural desire for the refinements and elegances of civilised life; but conversation and further acquaintance with the shabbily-dressed and roughly-housed citizens disproves this conclusion, for he finds them better educated in many respects, and abundantly supplied with that self-respect and desire to make a good appearance which in other countries induce people with similar incomes to display a much higher degree of external refinement. Further enquiry soon reveals the cause of this. It is due to the ridiculous prices that American citizens have to pay for almost every article of dress, and formost manufactured products. On the other hand, the extravagant dresses of the wives and daughters of the New York shoddyocracy, and the other recipients of the difference between the natural and the artificial prices of the poor man's clothes, and his other comforts and luxuries, shows what a delusion is cherished by those who imagine that the political institutions of the United States are specially devised for the promotion of social equality.

We have high tariffs in this country, but on what are they levied, and why are they levied? Tobacco, for example, pays heavy import duties, but these are not levied in order that a "ring" of British tobacco growers may obtain double the just value for their products. The increased price is not diverted by political wire-pulling into the pockets of a favoured or protected class, but goes entirely to the revenue, which is expended for the equal benefit of the whole nation. Then we find the duty is differential, and why this difference? Is it for the benefit of the class that legislates for us? Certainly not, but just the contrary. The higher tariff is laid upon the cigar which is smoked by the members of both Houses of Parliament and the class to which they belong, while the tobacco of the poor man's pipe pays the smaller duty. So with the rich wines of the rich man, produced entirely abroad; they pay heavy duties while the poor man's beer is taxed but nominally, although the brewery interest is very powerfully represented in the House of Commons, and has been during the whole of the present century. The horse and cart of the costermonger, the greengrocer, the butcher, the baker, the farmer, &c., pay no duty, but the horses and carriages of our Members of Parliament and the aristocratic class from which we derive nearly all our legislators, are heavily and directly taxed. The liveried servants of the peer, the landlord, the squire, &c., are specially taxed, but no tax is levied on the servants of the farmer or any kind of working trader, unless he chooses to mimic the aristocrat. Our "bloated aristocracy" cannot display their family escutcheons without being taxed for the privilege, and even the powder which some of them choose to put upon the heads of their footmen is specially taxed, simply because it is a luxury only used by the class that makes the taxes. The whole fabric of British taxation is built upon the principle of putting the heaviest burden on the luxuries of the rich and legislating class, and exempting the comforts and necessaries of the poor. When we compare this with the wire-pulling, dodging and scheming by which the legislature of the United States is packed with the representatives of class interests and of dodging commercial "rings," who are pledged to sacrifice the broad interests of their country and every sound principle of finance, or even to plunge the States into the horrors of civil war for the maintenance of class plunder in the form of protective tariffs, we may still sing "Rule, Britannia," and understand that her mission of diffusing civilisation by the example of British institutions is not confined to an Eastward extension, but is still demanded in the West.

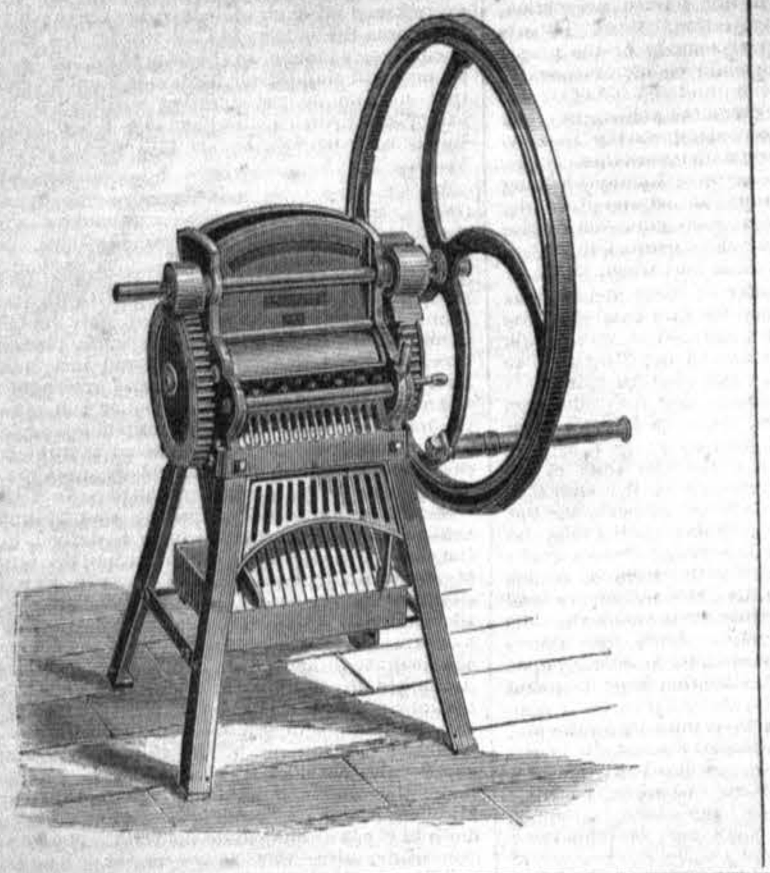
OUR TRADE SUMMARY.

DULNESS continues to characterise the iron trade almost everywhere, as compared with its condition three weeks or a month ago. Much of this is doubtless attributable to the deepening turmoil and excitement of a general election, and it is not unlikely that when the constituencies return to their normal state, a change for the better will again set in. Indeed, after a period of depression so prolonged and intense, it is not to be expected that the flow of prosperity should be full and steady from the turn. There has been a further decline in Glasgow warrants, and it is not surprising that speculative holders, after the losses they have sustained during the month bygone, should be regarding the future of pig-iron with distrust. The closing prices on Tuesday were as low as 55s. 9d. cash. Notwithstanding the reduction in prices, manufactured iron is also slow of sale; but there seems little if any decrease in the quantity turned out. The malleable ironworks are fully employed, but fresh orders are few in number, at existing prices at all events. The shipbuilding trade is still brisk, but also with few new contracts coming in. The steel makers are exceptionally busy, but a lull is perceptible in the engineering and ironfounding departments. At Middlesborough on Tuesday, Nos. 3 and 4 forge were down to 53s. for immediate delivery. The finished-iron trade, also, was rather easier. The shipbuilding trade is still troubled with the labour difficulty, which has culminated in locking out and rioting. The engineering department is, however, flourishing. In Durham and the Tyne districts there are likewise complaints of continued dulness; and in the latter the market for pig has been remarkably unsteady. Speculators, who at the commencement of the revival bought to hold for a further rise, are at their wits' ends whether to sell at once at considerable loss, or continue to hold at the risk of a still further drop. The majority, however, appear to take the hopeful view. The finished-iron trade participates to a considerable extent in the depression in the crude material. The shipbuilding industries of the Tyne continue in a flourishing condition, with contracts that will occupy them for a considerable time to come, irrespective of the new ones they may expect in the interval. Engine and boiler works and foundries are crowded with work. Quietness continues the rule in the hematite district of the north-west; but a revival in the spring and shipping season is confidently expected. For about two months makers have done no business, but that is because they have had sufficient orders in hand to keep their furnaces going during the whole of the present year, so that, although the value of hematite pig is down as low as £5 5s. for all-round qualities of Bessemer iron, and with forge in some cases down to £4 17s. 6d., many makers are refusing to do business except at fully £1 per ton advance on the highest market rates. The Barrow shipbuilders are doing fairly well, and engineers, boiler-makers and waggon builders are very busy. A weaker tone in pig-iron prevails in the Manchester district, and the weight of iron changing hands is small. Most of the finished-iron makers are, however, doing well; and founders, engineers and machinists are looking forward to a fair amount of trade in the early future. For all qualities of Staffordshire iron the demand is weaker and quotations lower. West Yorkshire, which was latest in feeling the improvement, seems to be tiding over the present dull period more successfully than most other districts; but the agricultural machinery department is, as might be expected, still depressed. From Sheffield the iron market is described as heavy and rather drooping, and, as regards all departments, no improvement is expected until the present electioneering fever has subsided. The elections are, without doubt, interfering with the placing of orders in the heavy cutlery trades. In Birmingham the animation which usually characterises the opening of the spring season is markedly absent, and only in a limited number of the varied departments of the local industries is there full employment. The export trade continues pretty active, however, and considerable orders have come in from America and Australia. There is no improvement to report in the coal trade.

WE have pleasure in announcing that Dr. C. William Siemens, D.C.L.; F.R.S.; was elected an Honorary member of the American Institute of Mining Engineers at their annual meeting held in New York, on the 17th February last.

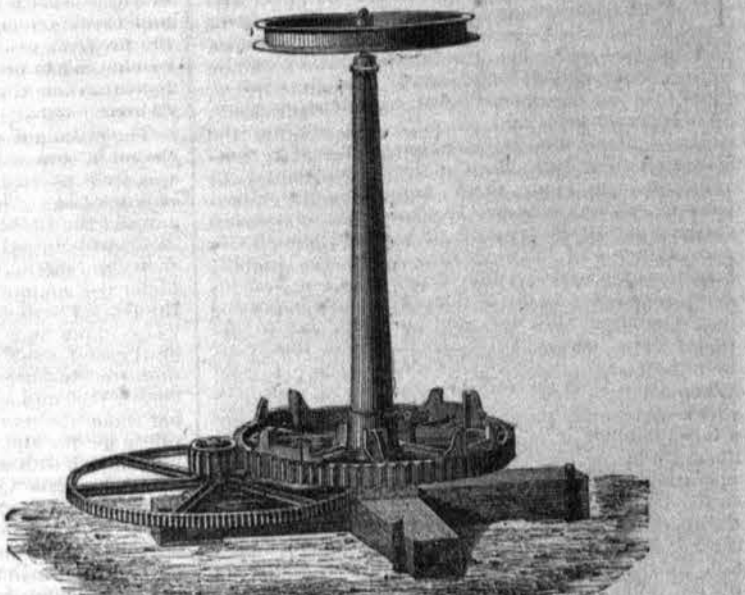
OIL-CAKE MILL.

BY MESSRS. JEFFERY AND BLACKSTONE, STAMFORD.



VERTICAL HORSE GEAR.

BY M. PINET.



OIL-CAKE MILL.

WE illustrate herewith an oil-cake mill by Messrs. Jeffery and Blackstone, of the Rutland Ironworks, Stamford, in which they have introduced several improvements in part also extending to their chaff-cutters and turnip-slicers. The main points consist in constructing the legs and frame of wrought angle iron. This adds greatly to their strength, and renders them easily taken to pieces for package and shipment, while very little time is required for their re-erection. The oil-cake mill was exhibited for the first time at the late Smithfield show. The mouth is made sufficiently wide to take in the broadest cake made; and the rolls are cast of such a composition of metal as enables them to break the hardest cake produced. The rolls are adjusted so as to break to six different sizes by two cams on a spindle shown in front of the machine. They are moved by the handle on the right; and the pin, also on the right, serves to keep them in the desired position. The back plate is arranged so as to turn down and form a kind of hopper, in which the pieces of broken cake are placed, if it be required to crush them any smaller. It will be noticed that the fly-wheel is of good size, and the gear double, that is to say, with a pinion at each end of the shaft, which is made long enough to receive a second fly-wheel or a driving pulley. The spur pinions are cased in, so as to prevent substances from getting between the teeth, or the men's clothes from being drawn in. The riddle at the bottom allows the finer particles to fall through into the tray, and also forms a spout for directing the broken pieces into any convenient receptacle.

PINET'S VERTICAL HORSE-GEAR.

IN our general notice of the Paris Cattle Show we referred to this vertical form of horse-gear, as commonly used on the Continent, having been devised by M. J. Pinet in 1854. It will be seen by the annexed engraving that motion is communicated to the principal wheel by horses acting on poles fitted in sockets, the rim taking all the strain. This wheel gears with a pinion on the second shaft, carrying also a spur-wheel, taking into a pinion on the third shaft inside the standard, and carrying the belt pulley. The simplicity of the arrangement, all on one bed-plate, will be noticed; while there is very little friction, owing to the absence of bevel gear, and the fact that the shafts run on foot-steps instead of in bearings. With horses, 125 revolutions a minute of the belt pulley are obtained, thus dispensing with the use of intermediate gear. This appliance was awarded a first-class medal at the 1855 Exhibition.

M. Zinin, the eminent chemist, of St. Petersburg, died recently. He was the discoverer of the production of the aniline colours by hydro-carburets.

THE INSTITUTION OF NAVAL ARCHITECTS.

OUR report last week of the Annual Meeting of the Institution of Naval Architects concluded with a brief reference to the proceedings on Thursday, the 18th inst., and a promise of details this week, which we now give. The proceedings of this sitting were opened with a short paper by Mr. N. Barnaby, C.B., on "The *Nelson* Class." The question, he said, was, now that these vessels were completed, were they fit for their proposed service? They might be looked upon from two points of view—as armoured ships and as protected cruisers. He thought in the first aspect they were fairly comparable with ships like the *Bellerophon*, and as cruisers with average coal they could steam out an average ocean speed of 12½ knots, with a consumption of 100 tons a day, while it ought to be remembered that the ship of war was endowed with a powerful rig, enabling her to cruise under sail for any length of time with no appreciable consumption of fuel.

Admiral Sir Spencer Robinson complimented the designer of the type, asserting that no war ships belonging to other Powers were able to carry so much coal. It was his opinion, however, that under sail they would not be of much service seeing they carried two screws. He closed his remarks by deeply lamenting the slow speed of our smaller class of ironclads.

Mr. A. C. Kirk, of the firm which built the *Northampton* and who designed the *Nelson's* engines, considered that the lesser speed of the *Northampton* was due to the different position of her propellers and the non-compounding of her engines.

Mr. J. Scott Russell, pointed out that the *Nelson* had eight unprotected guns in addition to four protected, which would be of the greatest advantage in delivering a broadside at close quarters. These could be fired by electricity, and it was arranged that the gunners should retire behind the armour when necessary.

The next paper was by Mr. John Scott Russell, F.R.S., on the "True Nature of the Resistance of Armour to Steel."

The object of his paper he said, was to eliminate from the twenty-five years of experience of armour of ships, one or two of the principles which he considered to be most completely established for use in future construction. After a lengthened investigation of principles and details, he stated the conclusions he considered deducible from these. Among his recommendations were the following—overlaying of the present armour, where additional protection is required, by a new coating of steel, the use of steel for elongated shells; and the application of the same principles which guide in the choice of armour to the construction of guns. Armour plates should be made by an inner coating of iron, and an outer of steel, they should also be made as broad as possible and in the construction of the ship itself, precaution should be taken in designing its structure to supplement the deficiency of strength in the joints of the armour by placing special strength behind these weak places, which he added was fully provided for in the design of that war ship of the future he had ventured to call the casemated ship. With respect to the question of how the structure of the ship and of the armour could be best combined he further urged that the armour-plates should be on the inside skin of the ship instead of the outside, and concluded by referring approvingly to the principle of Hughes' target, combined with a system of casemates and muzzle pivoting.

Mr. A. C. Kirk, M.I.C.E., followed with a paper "On a Method of Analysing the Forms of Ships and Determining the Lengths and Angle of Entrance." In this paper, Mr. Kirk laid before the Institution a method he had been in the habit of using to find the mean of a ship's entrance and its length. The method is by the construction of a block-ship having the same displacement, mean draught, and area of midship-section as the ship under consideration, but with rectangular sections, parallel middle body, if necessary, and strait-sided wedge shaped ends; and the author showed what he considered to be the simplest process for working out the desired result by this device.

The concluding paper read at this sitting was "On the Steam Trials of H.M.S. *Iris*, and the Resistance of Screw Propellers," by Mr. J. A. Normand. Referring to Mr. Wright's failure to account by Mr. Froude's theory for the great difference in the performance of the various screws used in these trials, the author said he had made a careful analysis of those experiments, and was of opinion that the discrepancies observed were very probably owing to an insufficient estimate of the direct resistance of the blades. It was, he thought, extremely probable that with smooth surfaces the direct resistance of screw propellers was greater than the friction, and it increased according to a higher power of the speed than friction. He believed, too, that it made no great difference of performance whether the screw-blades were rough or smooth. From that and other reasons he considered that instead of 1000 horse-power being lost by the resistance of the *Iris's* screw No. 1, at full speed, 2000 horse-power was nearer the case. In conclusion, he suggested two different kinds of experiments for solving the problem which was the subject of this paper. (1) To try screw-propellers exactly alike, but with very different thicknesses of blades, and also the same propellers with very different polish, which could easily be done in mixing sand with paint; and (2) to measure simultaneously the resistance of planes shaped like screw-blades, and moving obliquely through water. If, he concluded, the lateral resistance, that is to say the resistance perpendicular to the motion of the planes, could be recorded at the same time, which seemed relatively easy with the carriage used by Mr. Froude, these experiments would perhaps furnish sufficient data to establish a sound theory of the screw-propeller.

At the evening sitting, a paper, written by Mr. John R. Ravenhill, was read, which gave a history of the passenger-steamers on the passage between London and Gravesend. It stated that the Thames was the nursery from which emanated the light draught vessels first employed on the Rhine, the Seine, the Danube, and other European rivers, the Nile and Indian rivers. They were also the pioneers of the packets employed in the Channel and the Holyhead mail service. Gravesend, at the early date of the Norman Conquest, occupied an important position connected with the port of London and the water-passage between them, or, in other words, that portion of the River Thames, was known as the "Long Ferry," and was a great highway for merchandise and passengers. The traffic was carried on by sailing boats, called "tilt-boats;" and the last of these did not disappear until some twenty years after steamers were first placed on the station—the *Duke of York* finally succumbing in the year 1834. Steam was first introduced on the "Long Ferry," in 1815, and in 1840 there were nineteen steam packets plying between London and Gravesend, carrying during the year nearly a million passengers, one million and three-quarters being the highest numbers ever subsequently recorded in one season. After a reference to the accidents that had happened to the ships of this line, and in particular to the loss of the *Princess Alice*, Mr. Ravenhill thus concluded:—"The Watermen's Company, an old guild dating back from the 14th or 15th century, possesses the greatest possible powers in connection with the navigation of the river, and passenger river steamers must be navigated above Gravesend by one of their body, and although, happily, this frightful calamity above alluded to may be taken as exceptional, the public are beginning to inquire has the Company sought to elevate the position of its members by keeping pace with the times, and this enormous growth in traffic by requiring a better education to be a necessity amongst them, or by seeking any standard of merit or knowledge from a member prior to his taking charge of a steamer, with a living freight of several hundred people on board? The London Steamboat Company, at the present time the owners of a very large fleet of steamers plying both above and below bridge, are, amongst other matters in a Bill now before Parliament, seeking for relief from this monopoly, the like of which does not exist on any other river; and all interested in the navigation of the Thames are watching its progress, and for the answers by which these and similar questions will be replied to. Whatever may be the decision of Parliament, let us express the hope it will be welcomed as a wise and just one by the British public."

Several speakers extolled the London river steamers, but Mr. Martell considered they were a great disgrace to this country, and asked why they were not equal to those on the Mersey and Clyde.

Mr. Dixon Kemp read a paper on "The Stability of Yachts." He compared three types of yachts, and showed that depth rather than beam insured the highest stability at excessive angles of inclination. In a sea-way depth also gave the most easy motion.

A paper on "A Wave Line Form of Midship Section," by Mr. J. Scott Russell, concluded the business of the meeting.

The first paper read at the Friday morning sitting was "On Cellular Construction of Merchant Ships," by Mr. W. John. The author, in his opening remarks, observed that while change or evolution was constantly going on in the sizes, proportions and types of the ships of the mercantile marine, to meet the changing requirements of the trade, there had been along with this an apparent stagnation for years in structural improvements, or rather in the main structural arrangement of the material. The present was unquestionably a period of great change in mercantile shipbuilding, and he now proposed to review briefly the nature of the transition going on, and the steps that had led up to it. Many years ago Mr. Scott Russell successfully applied the longitudinal principle of construction, and a modification of that system had been for years adopted by the Admiralty in the bottom of their ironclads; but although the system had been strenuously advocated by Mr. Scott Russell and others before their own and kindred institutions, it had not taken root in the mercantile marine. He was nevertheless convinced that the mercantile shipbuilders and owners had shown some wisdom in adhering to the old transverse method for floors and frames. Quite recently longitudinal shipbuilding had, however, come into vogue, and there were at present about 100 steamers, of a total tonnage probably upwards of 200,000 tons, built and building with cellular bottoms. Mr. John next went at considerable length into the history of the development of the new method, and the many modifications and improvements that had been introduced since its commencement, taking his illustrations from the *Great Eastern*, the *Annette*, and others of Mr. Scott Russell's ships, and stating, in considerable detail, the objections, some of which were important, that might be brought against it, such as the lowering of cargo-capacity, liability to local damage from grounding, and the absence of any proof that a merchant ship, of the same size, built to the ordinary scantlings, was deficient in longitudinal strength. The longitudinal system, Mr. John continued, appeared to have migrated to the Admiralty at the commencement of ironclad shipbuilding. He then described the method of construction employed in several varieties of ironclads, and returning to the mercantile marine, pointed out that the cellular system did not so much add to longitudinal as to local strength, and maintained that it was only where an inner bottom was required, either for commercial purposes or for additional safety, that its replacement of the old-established, simple, and well-tried mercantile transverse principle of construction might be expected.

Mr. J. Scott Russell said he had been called the father of this longitudinal system, and it seemed, therefore, to be his duty to acknowledge all the faults he had committed, and to take upon himself all the failings which might be attributed to the system. Something that he had recently said had been understood as if he had meant to attribute to double bottoms some great faults or shortcomings, which he certainly did not intend to do; at the same time, he wished his hearers to take care that the good qualities that form of construction possessed should not be exaggerated. His favourite cellular bottoms had indeed one great fault, and it was this: If they used them in a small size of ship, or if in a large ship they were used in a part where access could not be had to them by the painter, they ruined their ship. The cells of the *Great Eastern* were everywhere of such a size that the painter could freely traverse them. In the *Annette* the cells were not closed up. One thing he might state with respect to the *Great Eastern*, she had a double bottom, but it was confined to the centre of the ship, because the shelving fore and aft would have made compartments inaccessible; but over those parts he had run a deck, the spaces below which were available for cargo, and thus he had secured many of the advantages of a double bottom.

Mr. William Denny said there were several points, chiefly in connection with the questions of economy of construction and tonnage, in relation to double bottoms, which he should like to see taken up. With regard to the first the single bottom was as heavy as the double bottom, and when the workmen had been trained to the new system he believed it would be as cheaply constructed as the other. And the double-bottom system gave a greater tonnage.

Mr. W. H. White observed that what they wanted in the navy was lightness with strength of hull, and if Mr. John would show them a way to get a greater lightness of hull with greater strength the Admiralty authorities would be well satisfied.

Mr. John, in reply, was glad to hear that Mr. Scott Russell did not condemn double bottoms. The correct inference to be drawn from the construction of short ironclads, he added, was that they got better results by putting the material in the position that would best meet local strains.

The next paper was "On Steel in the Shipbuilding Yard," by Mr. William Denny. The author's purpose in this paper was to give an account of some of the experience his firm had had in the use of mild steel during the last two years. It had first been used during the blockade-running period; but the material as then made being far from satisfactory, the result was not encouraging. The first time his firm had employed the mild steel now in use was in a light-draught paddle-steamer, the *Taeping*, which on one of her earliest trips ran upon a snag and came off safe and sound, while an iron vessel would probably have gone down under the same circumstances. Of the steel now supplied to them they had little cause to complain, except from uncertainty of delivery, probably occasioned by the newness of the works. Referring to some recent vessels built of steel as compared with those of iron, he said they had shipped six small steel steamers without losing anything by breakages, than which he thought nothing could have better shown the comparative reliability of iron and steel as a shipbuilding material. Indeed their whole experience led them to look with confidence on the steel and with doubt on the iron, and their workmen held this view of the matter very strongly. The only danger was from working at a black heat. Mr. Denny next referred to experiments bearing on the loss of strength in steel plates from annealing, on which account his firm had preferred the practice of rimelling punched holes, where such were required, to annealing the plates. With regard to the tensile strength of the plates, Lloyd's conditions were that it should not fall below twenty-seven tons, nor exceed thirty-one tons to the square inch; but he asked if it was necessary that they should restrict themselves to such very mild steel, as an increased tensile strength would greatly help the rigidity of the steamers, without any accompanying troublesome consequences? There were four matters of doubt and difficulty in the future of steel; the poor delivery yet attained by the steelworks, the practice adopted by Lloyd's of testing in the yard after delivery, the supposed greater liability of steel to corrosion, and the doubts entertained of its reliability and safety. He stated several important objections to the present testing arrangement, the removal of which, however, he believed to be under consideration; and as to corrosion, he believed the cause to be purely local and exceptional. In conclusion, he was of opinion that the supersession of iron by steel in shipbuilding was a mere question of time, and that its steadily lessening proportionate cost would undoubtedly hasten the change.

At the suggestion of Mr. Kirk, the remaining paper, "On Steel for Shipbuilding," by Mr. Henry H. West, Chief Surveyor to the Underwriters' Registry, Liverpool, was also read, in order that the two might be discussed together. Mr. West began by referring to the test standards of the Admiralty, which were all tensional tests, supplemented by cold bending tests, after heating the samples to a red heat and suddenly cooling them in water, the principal difference between these standards and the Underwriters' Registry being the breaking strain, which was in Lloyd's between 27 and 31 tons, and in the Underwriters' Registry between 28 and 32 tons. It had been practically found that a kindly working and fairly uniform material could be obtained with tension limits of 30 to 36 tons per square inch. The author then described the present testing practice of the Underwriters' Agency. Two principal tests, he continued, were necessary—one a test of tenacity, and another of ductility; and he proposed that a minimum standard of tenacity of 20 tons per square inch should be adopted without any maximum limit. That this, and even greater, could be produced without any dangerous sacrifice of ductility, he maintained had been abundantly demonstrated; and with perfect confidence he recommended that standard for general adoption in shipbuilding material.

Mr. Bramwell expressed his satisfaction that the author had advocated a minimum but not a maximum strength for shipbuilding steel. He thought Mr. West's opinion would commend itself to the meeting, and also that, as the ductility of the metal was increased, the minimum ought to be raised.

Dr. Siemens accepted the papers just read as very valuable, especially coming as they did from eminently practical men. He agreed with many of the opinions they had advanced; but there were certain points on which he disagreed with them. The principle put forward as all-important in these papers was the maximum of strength demanded from this steel; and he disagreed with the principle of the test of breaking strength. Dr. Siemens went on to say that if two qualities of steel, hard and mild, stood the test equally up to 15 tons to the inch, both were equally suitable for a purpose for which greater strength was not required. Again, as it had been forcibly put by Mr. Denny, while mild steel required no annealing, that process took some twenty per cent. out of hard qualities, so that it was better at once to employ a material which required no annealing and maintained its strength. This, he thought, was a powerful argument in favour of soft steel. There was another which was that if a material of low bending strain happened to be chilled accidentally this chill did not interfere with its strength, whereas, with the hard metal, they would have to contemplate with great concern the safety of any structure in which it was employed. He believed it was much safer to trust to a metal which stood a strong bending test. He entirely agreed with Mr. Denny that all plates should be tested at the works of the maker, and that in the most careful and rigorous manner.

Mr. Martell referred to the great importance of the fact that the harder the steel the more it lost in strength by punching and the other operations to which it was subjected in working; and with respect to the very strong remarks of the author, respecting the testing at the ship-yards, he observed that the meeting must bear in mind that Lloyd's committee felt they had a great responsibility imposed upon them, and that they were in consequence bound to lay down rules which would relieve them from some of those responsibilities which properly devolved on the shipbuilders. At the same time, if it could be clearly shown that the proposed change would not increase the responsibility now upon them, the committee, he had no doubt, would give the proposed change their serious consideration; and, as a matter of fact, he knew that they were now carefully considering it.

Mr. Kirk said that he for one felt very strongly on this matter of testing, and he hoped every shipbuilder and steelmaker present would contribute to the settlement of the question. With regard to Dr. Siemens' remarks, he (the speaker) maintained that it was not tensile strength that was in most cases required in a ship, but stiffness. It was a pity, he thought, that they were losing so much of the qualities of that excellent material, steel, by limiting its maximum strength. The saving in weight alone would pay very well for any increased difficulty that might be experienced in working.

Dr. Siemens replied that stiffness did not depend on the elongation of the breaking strain, but the deflection from ordinary strain. In that case the mild was as rigid as the harder metal.

Mr. W. Parker, of Lloyd's, said that out of about 3000 tons of English plates used for marine boilers lately, there had been only one or two failures, whereas in a number of plates from the Continent every one that had been tried had cracked and laminated on the edges while being worked in the fire. Yet there was a very slight difference in the composition of these plates. They failed when heat as applied in the process of flanging; but in every other respect the Continental plates appeared to be as good as the English. He had had these plates analysed and samples tested under various degrees of temperature, but failed to discover the cause of their strange behaviour. On making further enquiries, he ascertained that the manufacturers of these plates were not aware that they had to be tortured by flanging, and had therefore not made the blooms large enough to admit of sufficient margin being cut off the edges to ensure soundness. When the injured plates were cut through they were found to flange perfectly. Had this investigation not been made, the material would in all probability have been considered unfit for its intended purpose, and would have been condemned.

Sir John Alleyne strongly objected to the practice of Lloyd's in testing the metal at the shipyards. With respect to high and low tests, he said that if they had a low limit of elasticity in steel they brought iron into competition with it, and they were sacrificing some of the qualities of the former material when they used it of low elasticity.

Mr. Corrie, of Lloyd's, said they did not object to a higher tensile strength in the steel if it retained its elasticity. If these riveted joints could not be made up to thirty tons to the inch, it was of no use making the plates up to that strength.

Mr. Thorniecroft said they required, if possible, a stronger steel than they now had, and he thought the tests should go above 32. In the working, hard steel, they often found, would submit to what iron refused to undergo. In accidents, also, the harder metal came out well.

Mr. Hamilton thought that too much had been made, in connection with the question of stronger steel, of the difficulties with respect to the strength of joints, which could be obviated in several ways.

Mr. Riley considered that the present system of testing was, at all events, a safe one, and if it was necessary to change it the change should be cautiously made. He suggested that the more ductile material might be used for the outside and the more rigid for the inside of ships.

Mr. Henry Laird said his firm used steel rivets generally, and he believed they would be of great service, if of good quality, and if care were taken in heating. They never had a single failure when the metal was worked cold in the state in which they received it. As to strength, he thought they should go as far as they could without having to anneal. In 1850 his firm had built the *Greyhound* with plates 3-16ths thick, and he believed she was now at work and in admirable order. Mr. Laird adduced the case of one of their ships, the bottom of which was of very good metal, and it had survived an accident which would have occasioned the immediate sinking of an ordinary iron vessel.

Mr. Denny, in the course of a brief reply, observed that Lloyd's representatives had made no real defence to his objections to their testing practice.

At the evening sitting, the first paper was a very abstruse one by Mr. J. McFarlane Gray, entitled "A Simplification of the Thermodynamics of Steam," the object of which, as he stated in the outset, was to extend the application of the molecular hypothesis to explain the known relations of heat and mechanical effect. After a lengthened dissertation on the action of molecules in the production of the energy of heat, Mr. Gray proceeded to explain what he called a "thetaphi" diagram, by means of which he claimed there was shown, not only the amount of work done by steam, as was shown by the common indicator diagram, but also the whole transfer of energy.

Mr. Scott Russell said the subject just placed before them was so mysterious and etherial, so infinitely little in the quantities with which it dealt, and so infinitely large in those necessary to measure and comprehend it, that he did not think they could by any quantity of talk in that room assist each other to comprehend it. If Mr. Gray had succeeded by his geometrical representation in giving them an exact conception of all the calculations that had hitherto been made on the subject, in the place of unintelligible formulae, then he would say he had done them a great service. At the same time he was not sure that the mere dance of atoms was what was called heat.

A paper "On Some Recent Experiments in Artificial Combustion," was read by Mr. J. F. Flannery. Introducing the subject of his paper the author referred to an article in *Naval Science* by Sir Spencer Robinson, in which the disadvantages attending the use of Welsh coal in the navy from deterioration were shown, and observed in continuation that there could be no doubt Welsh steam coal, north-country coal, or any mixture of these, was inferior to anthracite for the purposes of marine consumption, especially in war ships. The latter possessed greater evaporative efficiency, and producing no smoke, the position of such vessels was thereby concealed, whilst the heating surface of the boiler was less liable to foul. Anthracite, besides possessing greater cohesion, was not so liable as the others to be broken in transport or in a ship's bunkers, and containing very little sulphur was not subject in the same degree to decay and spontaneous combustion. Notwithstanding all these advantages, owing to difficulties attending its combustion it was now almost entirely confined to the drying of malt; but by the expedient of making the firebars hollow and passing the blast through them—a system originating with Mr. Perkins, of Swansea, and elaborated by the author—the difficulty attending its consumption as a steam-coal had been overcome. Mr. Flannery then, with the assistance of drawings, explained his apparatus, and exhibited in a tabular form the results of comparative experiments with this artificial draft furnace, and an ordinary one. The mean results of these experiments showed a gain of 40 per cent. in the consumption of anthracite, per foot of fire-grate, as compared with Welsh steam-coal, and of 77 per cent. as compared with anthracite in common bars; a gain of 0 per cent. and 6 per cent. in evaporation per pound of cost and a gain of 37 per cent. and 100 per cent. in evaporation per square foot of fire-grate. Scarcely any ash was collected. The author concluded by stating that inferior coal might be used with his furnace without reducing the power of the boilers and the height of the funnel much reduced.

Mr. Wright thought, as far as he understood the experiments, Mr. Flannery had taken too sanguine a view of the results obtained.

Dr. Frankland observed that anthracite was much more powerful in raising steam than ordinary coal, but was more difficult to burn. In Wales the gases from anthracite were utilised in raising steam in the boiler.

Admiral Selwyn pointed out that the harder the coal the more waste of power was expended in disintegrating it, and disintegration was essential to combustion. On this part of the question he referred to his own experiments on the hydrocarbons. In America he also said they had difficulties about the best mode of burning anthracite, but they never professed to be able to get more out of it than out of good Welsh coal. He thought there was a better prospect in improving the boiler.

Mr. Flannery, in reply, pointed out that the difficulty with anthracite had always been its slowness of combustion, and that he had got an increase in that respect of 77 per cent., with, at the same time, a slight increase in economy.

The closing paper was by Mr. C. W. Merrifield, F.R.S., "On J. Amsler Laffon's Mechanical Integrator." The object of this instrument is to find the area, the statical moment, and the moment of inertia of any closed curve, by simply tracing out the curve with a pointer, the machine doing all the rest, and the results are read off directly from it without any trouble of calculation. Mr. Merrifield exhibited the instrument, and by means of diagrams described its mode of working. Its arrangements, he said, were exceedingly well devised, and the machine worked smoothly and easily.

Mr. W. H. White said everybody engaged in ship calculation would be aware that an instrument of this description had been wished for for years. It would also enable them to calculate the curve of stability.

Mr. Scott Russell had seen many of Amsler's inventions, but the present appeared to be the culmination of them all. Such an instrument, however, was best used for testing rather than making calculations.

This closed the business on the agenda; but Sir Spencer Robinson now rose, and on the occasion of Lord Hampton's last appearance as Chairman of the Institution, expressed the regret felt by its members, and proposed a cordial and grateful vote of thanks to his lordship for the important services he had rendered them during the twenty-one years he had officiated as their President. Sir Spencer Robinson also presented Lord Hampton with an illuminated address of thanks, which attributed to his lordship's care and ability much of the success that had attended the Institution, concluding with a hope that he would be spared for many years to come to give them the benefit of his invaluable advice and assistance, and stating that his lordship would carry with him on his retirement the good wishes of every member. The resolution was seconded by Mr. Scott Russell and adopted by acclamation.

Lord Hampton said he felt quite overcome by the great kindness that had been now shown him, and he knew not how to give expression to his feelings on the occasion. He certainly expected that they would give him a kind and friendly farewell, but he was not in the least prepared for such a touching proof of the great kindness and friendship with which they were so good as to regard him, and the over-estimation they were kind enough to make of his services during twenty-one years. He could only assure them that he was greatly affected by that proof of their good opinion. It was the last occasion on which he should occupy the chair, but what chiefly mitigated the regret he felt on that account was that he should leave the presidency in the hands of his noble friend, Lord Ravensworth, who, he believed, had the welfare of their Institution as much at heart as he himself had, with more ability to carry it out. Although, also, he (the speaker) would cease to occupy the chair, he should not cease to be a member of the Institution, and, as vice-president, he should hope, as long as he had health and strength, to take a part in the various proceedings of the Institution. He hoped, as long as he lived, to retain the friendships he had formed among such a body of eminent men, and should cherish as long the token of it they had now given him.

The proceedings then terminated, after a vote of thanks to the Society of Arts for the use of the hall, and to the Council of the Institution for its services during the past year.

OCCASIONAL NOTES.

ARMED MERCHANT STEAMERS.

THE critical state of the Continent just now lends additional interest to the paper read by Mr. Donald Currie at the United Service Institution a fortnight ago, the discussion on which was concluded on Thursday last week. Mr. Currie, it may be remembered, after indicating the vulnerable character of our commerce and the increased capacity for action of the Continental powers, especially of Russia, at sea, pointed out that the first effort of an enemy would be to cut off our telegraphic communication with our dependencies, which would render necessary the use of mail steamers to keep the communications open. Merchant steamers might be utilised for that and other purposes, but the Government had not offered suitable encouragement to the owners to whom they had applied. He then entered into details to show how such vessels could be fitted so as to be ready to take an armament on board at a short notice, and urged that Government should arrange to pay a subsidy to ships prepared at any moment to be given up to its service, while stipulating that some of the crew employed in them should belong to the Naval Reserve. The adaptation of the merchant-steamer fleet to war purposes would have been easily practical before the introduction of armoured ships; but it appears doubtful whether the vessels composing it could be sufficiently strengthened to meet the iron-plated cruisers that might, in the event of war, be sent against them. At the same time, looking to the extent of our ocean carrying trade, and to the fact that we import half or nearly half our food supplies from distant ports, the ruin that the *Alabama* in two years brought upon the trade of the United States ought to be kept in vivid remembrance by British statesmen. Another obstacle in the way of utilising merchant-ships for defence, the number of foreign sailors in the service, was strongly insisted on in the course of the discussion. There is also the danger, in the event of England being engaged in war, of the enemy sending privateers among our merchantmen, the treaty of Paris notwithstanding; but against these, merchant-ships might, with some preparation, be able to protect themselves. Perhaps the Admiralty have confined themselves too much to the building of monster ironclads, to the neglect of small handy cruisers which might be trusted to clear the seas speedily of any number of ships of the *Alabama* class. Several useful suggestions in other directions were thrown out in the course of the discussion, such as the establishment of graving docks and fortified coal depots at Sierra Leone, and other ports, and the arming of merchant-ships with torpedoes.

MIGRATION FROM EUROPE TO AMERICA.

Of the swarms from her human hives that Europe is continually throwing off, the vast majority head westward, and it was from the East that Europe was itself peopled by successive migrations, commencing long before the historic period, and perhaps not yet finished. In this tendency towards extension westward plants appear to participate, for Professor Claypole, of Montreal, recently called attention to and enumerated a vast number of weeds which have migrated from Europe to America, and become so thoroughly naturalised as to prevail over some of the plants native to the soil; while only three or four American weeds have crossed the Atlantic and become naturalised in Europe. One of these, however, although the Professor does not mention it, is the irrepressible water-plant, nicknamed by somebody *Babingtonia diabolica*, which is choking up our canals, and making itself everywhere obnoxious. The marked difference in the migrative power of the two floras, the Professor went on to show, could not be considered as fully accounted for by any difference in climate between the two continents, or by the conditions of their mutual commerce. But he suggested that as the American plants had not changed much from the type existing in the Western hemisphere during the Miocene period, while those of Europe had been vastly altered, the long persistence of type of the American plants might have induced a rigidity or indisposition to change, as the plasticity thus shown to be characteristic of those of Europe might make them better able than the others to adapt themselves to a strange climate and conditions. With regard to the emigration of European men and women to America, a startling document was quite recently presented to the German Parliament, from which it appears that last year between thirty-three and thirty-four thousand Germans, two-thirds of them males, and nearly all bound for America, took ship at four of the northern Continental ports, and that by no means represents the entire loss of subjects annually suffered by the Empire. In 1872 and 1873, immediately after the war, the numbers were 125,650 and 103,638 respectively.

THE DANGERS OF TUNNEL-DRIVING.

The disease and mortality among the labourers in the St. Gothard Tunnel has been excessive. The distance between the entrances to the tunnel and the places where the perforators were at work, which was nearly five miles on the north side, coupled with the frequent freezing of the compressers, rendered ventilation extremely difficult, and the air was further fouled by perpetual explosions of dynamite, the smoke of about 500 oil lamps, and the exhalations from the bodies of 400 men and 40 horses in a temperature of 80° to 95° Fah. The horses, although working only eight hours out of the twenty-four, died at the rate of 25 per cent. per month, dropping down generally as if shot, as the contractor, M. Favre, himself did. For boys it was certain death to labour in the pestiferous atmosphere for any length of time; and of the grown men many died of a strange disease called tunnel trichinosis, from the presence in the intestines of the sufferers of an entozoon, either causing or accompanying it. About ten hours spent in the tunnel is stated to be sufficient to induce this painful malady. The appearance of the St. Gothard miners suffering from this disease, as nearly all of them are, is described as deplorable in the extreme. Their faces are yellow, their features drawn, eyes half-closed, lips discoloured, skin humid and gait difficult. If they eat with appetite they cannot digest, and wine, when taken, is invariably rejected. Let a man, it is added, be as strong as he may, three or four months' work in the tunnel severely injures his health, and at the end of the year he is a confirmed invalid. This account may be a little exaggerated, but making every allowance for that, it is plain that the work has been hurried on with too little attention to the sanitary condition of those employed on it, and without allowing them, by some system of relays, of recruiting themselves after a shift in what the Italian professors stigmatise as "a veritable hell."

AN UNSUSPECTED INLET FOR DISEASE.

The health officer for Kensington, Dr. Dudfield, in a recent report, has, with much acuteness, pointed to a source of disease previously unsuspected, or at least unnoted. He had observed that in the great majority of instances in his district the smallpox only attacked one person in a house, and that, in a considerable number of cases, was the female servant. He observed also that the symptoms first showed themselves when they might have been expected had the disease been contracted on the girl's Sunday out. In one month alone, out of a total of twenty-seven cases, one to a house, no fewer than twelve were domestic servants. The female servants in London are usually drawn from a class not so respectable or well-housed as those in the country; and although it is impossible and would be improper to prevent them from occasionally visiting their relatives, it would be well for employers to be on their guard and take all precautions in their power to prevent the poison of smallpox and other infectious diseases from being thus brought into their families from the over-crowded habitations of the poor.

MEAT SUPPLY FROM NEW SOUTH WALES.

The successful shipment of preserved meat by the *Strathleven* has produced great excitement at Sydney, where growers are anxiously waiting for the demand which the safe arrival of the *Strathleven's* consignment is expected to create in the English market. At the present time at Sydney prime beef is not worth more than 13s. per 100 lb., and the average price in the wholesale markets not more than 1¼d. per lb., which the carriage to London or Liverpool would not raise to above 4d. a pound. A correspondent of *The Times*, writing from Sydney, estimates the numbers of cattle and sheep in the colony at seven and sixty-three millions respectively, adding that this number might be doubled if there was a sufficient demand, and that one-fifth of the stock might be profitably exported. Fresh beef and mutton might therefore be imported from Australia at a cheaper rate than from America, and the correspondent from whom we quote maintains that Australian meat is superior in quality to American. In explanation, he says that the sheep are nearly all of the small, sweet-fleshed Merino breed, and that for the last twenty years the cattle have been steadily improved. One-half of the cattle are shorthorns, and there is scarcely any disease amongst either cattle or sheep. Possibly the disastrous state of the English flocks may help to establish the trade begun by the *Strathleven*.

ILLUSTRATED SCIENTIFIC LITERATURE.—No. VI.*

(For illustrations see following page.)

WE present our readers with some extracts from the fourth and concluding section of Deschanel's "Natural Philosophy."†

"*Method of Counting Vibrations. Siren.*—The instrument which is chiefly employed for counting the number of vibrations corresponding to a given note, is called the *siren*, and was devised by Cagniard de Latour. It is represented in figs. 583, 584,‡ the former being a front, and the latter a back view.

"There is a small wind chest, nearly cylindrical, having its top pierced with fifteen holes, disposed at equal distances round the circumference of a circle. Just over this, and nearly touching it, is a movable circular plate, pierced with the same number of holes similar arranged, and so mounted that it can rotate very freely about its centre, carrying with it the vertical axis to which it is attached. This rotation is effected by the action of the wind, which enters the wind-chest from below, and escapes through the holes. They do not pass perpendicularly through the plates, but slope contrary ways, so that the air when forced through the holes in the lower plate impinges *upon one side* of the holes in the upper plate, and thus blows it round in a definite direction. The instrument is driven by means of the bellows shown in fig. 595.‡ As the rotation of one plate upon the other causes the holes to be alternately opened and closed, the wind escapes in successive puffs, whose frequency depends upon the rate of rotation. Hence a note is emitted which rises in pitch as the rotation becomes more rapid. The siren will sound under water, if water is forced through it instead of air; and it was from this circumstance that it derived its name."

"*Graphic Method.*—In the hands of a skilful operator, with a good musical ear, the siren is capable of yielding very accurate determinations, especially if, by adding or subtracting the number of beats, correction be made for any slight difference of pitch between the siren and the note under investigation.

"The vibrations of a tuning fork can be counted, without the aid of the siren, by a graphical method, which does not call for any exercise of musical judgment, but simply involves the performance of a mechanical operation.

"The tuning-fork is fixed in a horizontal position, as shown in fig. 585, and has a light style, which may be of brass wire, quill, or bristle, attached to one of its prongs by wax. To receive the trace a piece of smoked paper is gummed round a cylinder, which can be turned by a handle, a screw cut on the axis causing it at the same time to travel endwise. The cylinder is placed so that the style barely touches the blackened surface. The fork is then made to vibrate by blowing it, and the cylinder is turned. The result is a wavy line traced on the blackened surface, and the number of wave-forms (each including a pair of bends in opposite directions) corresponds to the number of vibrations. If the experiment lasts for a measured interval of time, we have only to count these wave forms, and divide by the number of seconds, in order to obtain the number of vibrations per second for the note of the tuning-fork. By plunging the paper in ether, the trace will be fixed, so that the paper may be laid aside and the vibrations counted at leisure. The apparatus is called the *vibroscope*, and was invented by Duhamel."

"*Organ-pipes.* — In organs, and wind-instruments generally, the sonorous body is a column of air confined in a tube. To set this air in vibration some kind of mouth-piece must be employed. That which is most extensively used in organs is called the *flute mouth-piece*,§ and is represented, in conjunction with the pipe to which it is attached, in figs. 593, 594. It closely resembles the mouth-piece of an ordinary whistle. The air from the bellows arrives through the conical tube at the lower end, and, escaping through a narrow slit, grazes the edge of a wedge placed opposite. A rushing noise is thus produced, which contains, among its constituents, the note to which the column of air in the pipe is capable of resounding; and as soon as this resonance occurs, the pipe speaks. Fig. 593 represents a wooden and fig. 594 a metal organ-pipe, both of them being furnished with flute mouth-pieces. The two arrows in the sections are intended to suggest the two courses which the wind may take as it issues from the slit, one of which it actually selects to the exclusion of the other.

"The arrangements for admitting the wind to the pipes by putting down the keys are shown in fig. 595. The bellows, V, are worked by the treadle, P. The force of the blast can be increased by weighting the top of the bellows, or by pressing on the rod, T. The air passes up from the bellows, through a large tube shown at one end, into a reservoir, C, called the wind-chest. In the top of the wind-chest there are numerous openings, *c*, *d*, &c., in which the tubes are to be fixed. The sectional drawing in the upper part of the figure shows the internal communications. A plate, K, pressed up by a spring, R, cuts off the tube, *c*, from the wind-chest, until the pin, *a*, is depressed. The putting down of this pin lowers the plate, and admits the wind. This description only applies to the experimental organs which are constructed for lecture illustration. In real organs the pressure of the wind in the bellows is constant; and as this pressure would be too great for most of the pipes, the several apertures of admission are partially plugged, to diminish the force of the blast."

"*Lissajous' Experiment.*—Suppose we introduce into a dark room (fig. 602) a beam of solar rays, which, after passing through a lens, L, is reflected, first from a small mirror fixed on one of the branches of a tuning fork, D, and then from a second mirror, M, which throws it on a screen, E; we can thus, by proper adjustments, form upon the screen a sharp and bright image of the sun, which will appear as a small spot of light. As long as the apparatus remains at rest we shall not observe any movement of the image; but if the tuning-fork vibrates the image will move rapidly up and down along the line, I, I', producing, in consequence of the persistence of impressions, the appearance of a vertical line of light. If the tuning-fork remains at rest, but the mirror, M, is rotated through a small angle about a vertical axis, the image will move horizontally. Consequently, if both these motions take place simultaneously, the spot of light will trace out on the screen a sinuous line, as represented in the figure, each S-shaped portion corresponding to one vibration of the tuning-fork.

"Now, let the mirror, M, be replaced by a small mirror attached to a second tuning-fork, which vibrates in a horizontal plane, as in fig. 603. If this fork vibrates alone, the image will move to and fro horizontally, presenting the appearance of a horizontal line of light, which gradually shortens as the vibrations die away. If both forks vibrate simultaneously, the spot of light will rise and fall according to the movements of the first fork, and will travel left and right according to the movements of the second fork. The curve actually described, as the resultant of these two component motions, is often extremely beautiful. Some varieties of it are represented in fig. 604.

"Instead of throwing the curves on a screen, we may see them by looking into a second mirror, either with a telescope as in fig. 603, or with the naked eye. In this form of the experiment, a lamp surrounded by an opaque cylinder, pierced with a small hole just opposite the flame, as represented in the figure, is a very convenient source of light.

"The movement of the image depends almost entirely on the angular movements of the mirrors, not on their movements of translation; but the distinction is of no importance, for, in the case of such small movements, the linear and angular changes may be regarded as strictly proportional."

"*Formulæ for Refraction through Prisms. Minimum Deviation.*—Let S I (fig. 666) be an incident ray in the plane of a principal section A B C of a prism. Let i be the angle of incidence S I N, and r the angle of refraction M I I'. Then, denoting the index of refraction by μ, we have $\sin i = \mu \sin r$. In like manner, putting r' for the angle of internal incidence on the second face I I' M, and i' for the angle of external refraction N' I' R, we have $\sin i' = \mu \sin r'$.

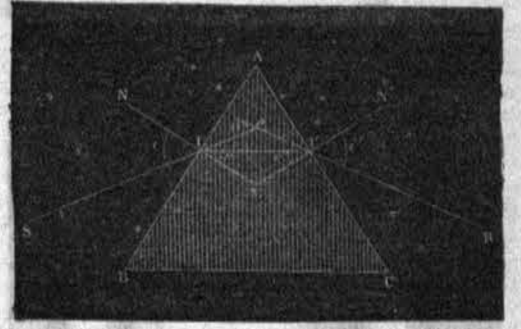


Fig. 666.—Refraction through Prism.

The deviation produced at I is $i - r$, and that at I' is $i' - r'$, so that the total deviation, which is the acute angle D contained between the rays S I, R I', when produced to meet at o, is

$$D = i - r + i' - r'. \qquad (1)$$

But if we drop a perpendicular from the angular point A on the ray I I', it will divide the refracting angle B A C into two parts, of which that on the left will be equal to r, and that on the right to r', since the angle contained between two lines is equal to that contained between their perpendiculars. We have therefore $A = r + r'$, and by substitution in the above equation

$$D = i + i' - A. \qquad (2)$$

When the path of the ray through the prism I I' makes equal angles with the two faces, the whole course of the ray is symmetrical with respect to a plane bisecting the refracting angle, so that we have

$$i = i'; \ r = r' = \frac{A}{2}.$$

Equation (2) thus becomes

$$D = 2i - A, \text{ whence } i = \frac{A+D}{2}, \qquad (3)$$

$$\text{and } \mu = \frac{\sin i}{\sin r} = \frac{\sin \frac{A+D}{2}}{\sin \frac{A}{2}}. \qquad (4)$$

This last result is of great practical importance, as it enables us to calculate the index of refraction μ from measurements of the refracting angle A of the prism, and of the deviation D which occurs when the ray passes symmetrically.

"When a beam of sunlight in a dark room is transmitted through a prism, it will be found, on rotating the prism about its axis, that there is a certain mean position which gives smaller deviation of the transmitted light than positions on either side of it; and that, when the prism is in this position, a small rotation of it has no sensible effect on the amount of deviation. The position determined experimentally by these conditions, and known as the *position of minimum deviation*, is the position in which the ray passes symmetrically."

"*Focometer.*—Silbermann's focometer (fig. 684) is an instrument for measuring the focal lengths of convex lenses, and is based on the principle, that, when the object and its image are equidistant from the lens, their distance from each other is four times the focal length. It consists of a graduated rule carrying three runners M, L, M'. The middle one, L, is the support for the lens which is to be examined; the other two, M M', contain two thin plates of horn or other translucent material, ruled with lines, which are at the same distance apart in both. The sliders must be adjusted until the image of one of these plates is thrown upon the other plate, without enlargement or diminution, as tested by the coincidence of the ruled lines of the image with those of the plate on which it is cast. The distance between M and M' is then read off, and divided by 4."

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[*] This series was begun in No. 341 of IRON, and was thus introduced:—

Under the present heading we hope to bring before our readers from time to time samples of the cotemporary scientific literature of Europe taken from the works themselves. These extracts we should give in place of the ordinary notice, which, if given in the common way, in our column of Reviews, would necessarily be critical in character. Our endeavour is thus to convey to our readers some idea of new books, by a more or less perfect sampling of them. The original drawings will be given, and will, as far as possible, be accompanied by the original text. It will, of course, be evident that in one essential particular our "sampling" will sometimes fall short of the original. In the printing of engravings in book form the manipulations necessary for bringing out their full effects are much more possible than when they are placed in the columns of a newspaper; and reader and publisher will alike understand that we cannot pretend to effects in the rendering of illustrations which claim to be more than approximative. Still, we hope to be so largely useful to the book-buying public as to be justified in reckoning on its most favourable construction of our efforts.

[†] Deschanel's Natural Philosophy, translated and edited with extensive additions by J. D. Everett, M.A., D.C.L., F.R.S.E. Part IV. Sound and Light. Illustrated by 187 engravings on wood, and one coloured plate. London: Blackie and Son, Old Bailey, E.C.

[‡] Not shown here.

[‡] Not shown here.

[§] This is not the trade name. English organ-builders have no generic name for this mouth-piece.

ILLUSTRATED SCIENTIFIC LITERATURE.

(*For description see preceding page.*)

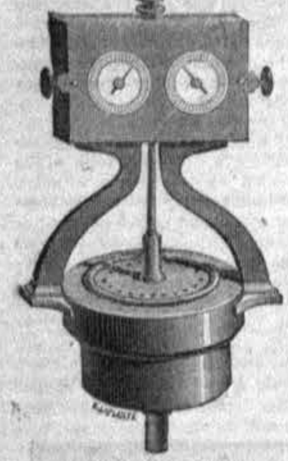

Fig. 583.—Siren.

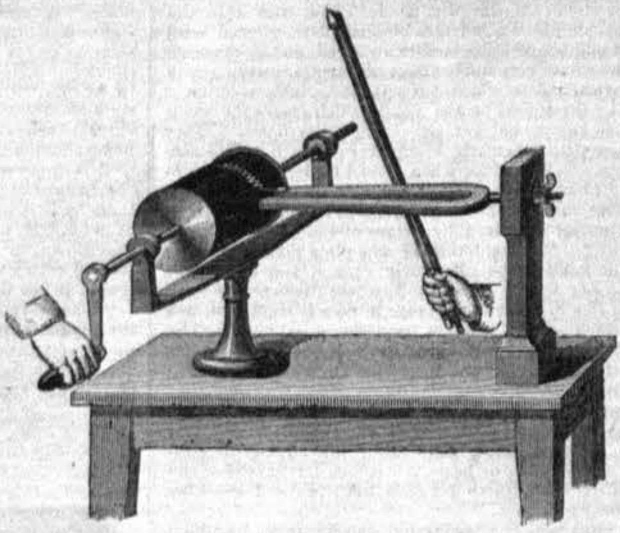

Fig. 585.—Vibroscope.

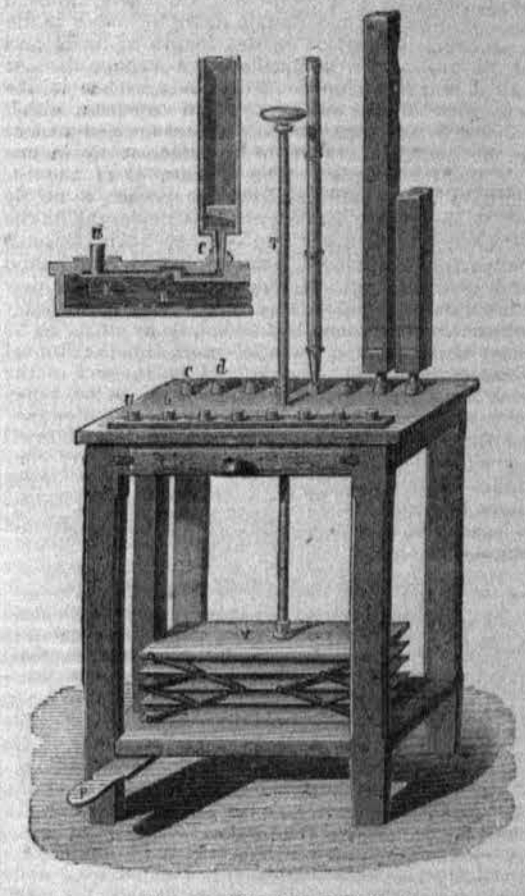

Fig. 595.—Experimental Organ.

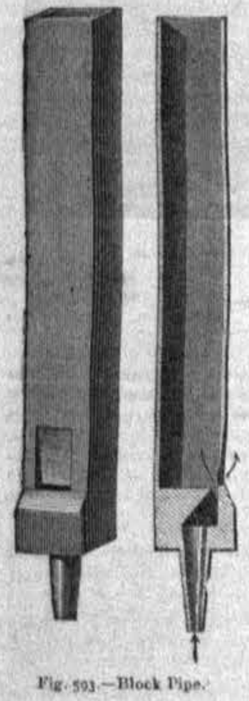

Fig. 593.—Block Pipe.

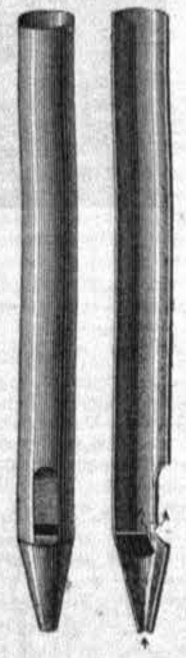

Fig. 594.—Flue Pipe.

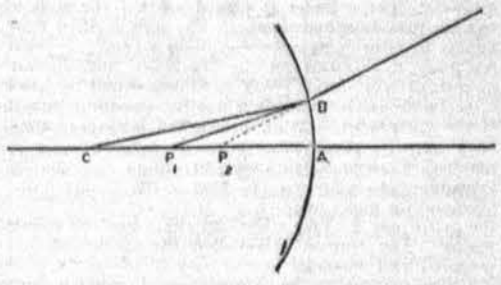

Fig. 684a.

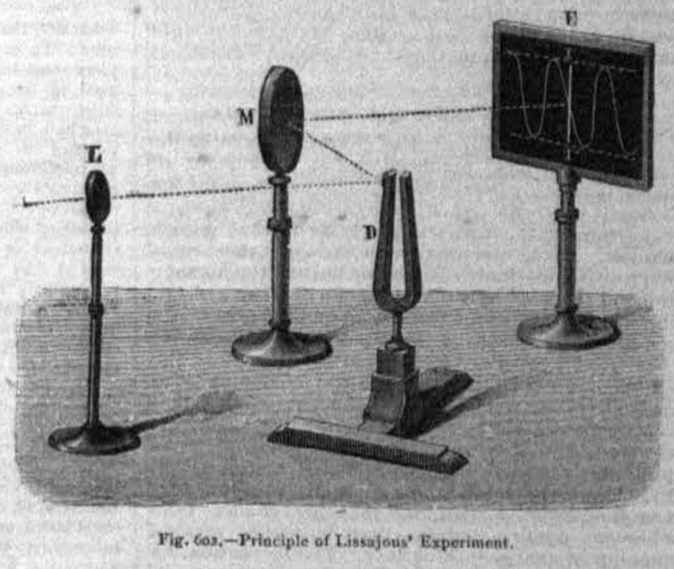

Fig. 602.—Principle of Lissajous' Experiment.

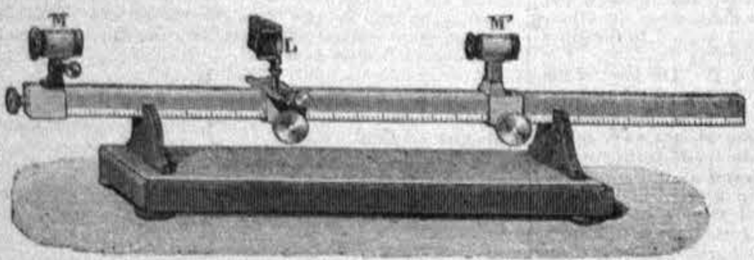

Fig. 684.—Silbermann's Focometer.

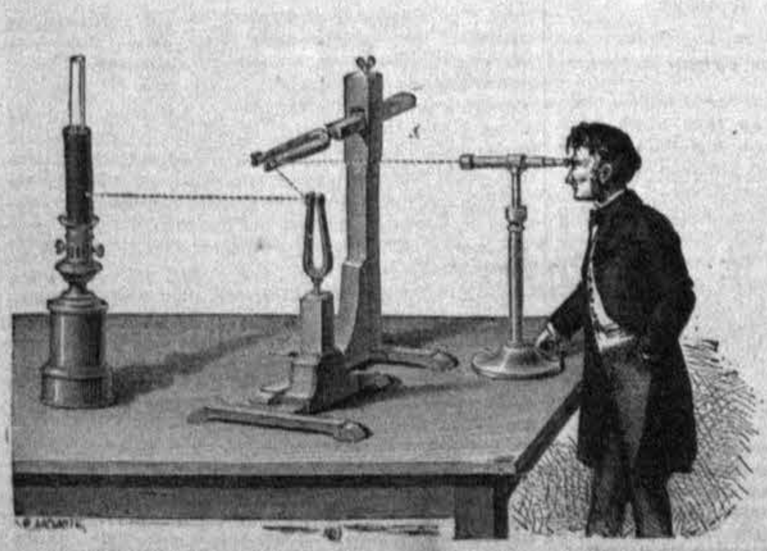

Fig. 603.—Lissajous' Experiment.

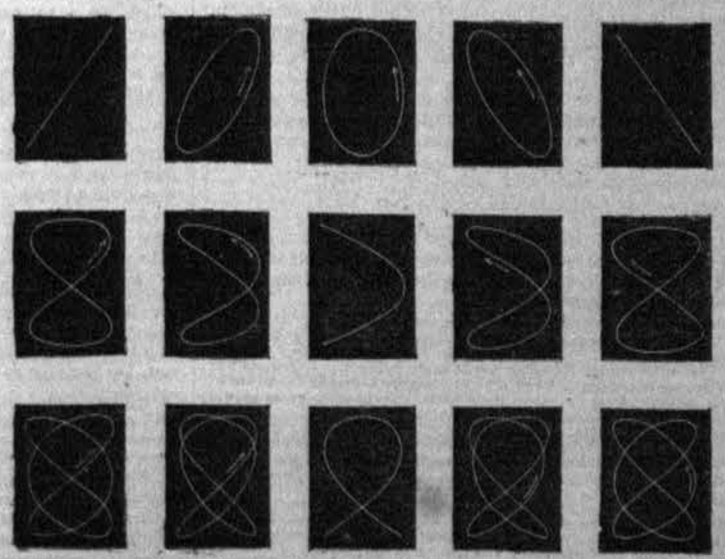

Fig. 604.—Lissajous' Figures—Unison, Octave, and Fifth.

THE "NELSON" CLASS.

By N. BARNABY, Esq., C.B.*

IN a Table appended to this paper I give particulars as to the two ships *Nelson* and *Northampton* as they have been completed, including the trials of speed; and I place beside them corresponding particulars of two excellent ships of an earlier type, designed for similar work—the *Iron Duke* and the *Bellerophon*. I regret to have to admit the fact that, while the *Nelson* is a 14-knot ship on the mile *without* the use of the steam-blast, the sister ship, notwithstanding that the engines are the perfection of workmanship and material, is at present only a 13¼-knot ship *with* the steam-blast. The difference is due mainly to the difference in the performance of the two types of engines, particularly of the propellers, and partly to the fact that, from some cause, the *Northampton* always needs starboard helm to keep her on a straight course, and this checks her way. When the screws of the *Northampton* are altered, it will probably be possible to greatly reduce the difference between the two ships. I may be permitted to add that the *Northampton* left Spithead for her station with 1200 tons of coal in her bunkers, and with her gun-deck portsills 11½ feet out of water. The *Nelson* will float under the same conditions about 5 inches lighter, and will thus have, with 1200 tons of fuel, nearly a 12-feet height of port. Public attention has been called to a discrepancy between the draught of water named when the ship was first designed and that at which it was completed, as though it were desirable to prefer strict adherence to a draught of water to the introduction of newly-devised sources of warlike efficiency. The designer of the ship should be judged by the performance of the completed ship, and not by the strictness of the accordance between the weights he proposed to put in in 1874 and those which he was prepared to adopt at various stages up to the date of completion in 1879.

The real question concerning the "*Nelson*" Class is, now that they are completed, are they fit for their proposed service? I shall be prepared to answer any questions concerning alleged discrepancies which may be thought interesting; but what most people will care about is, what services are the ships designed to perform, and what promise is there of due performance? The ships may be looked at from two points of view. They may be regarded as *armoured ships*, having to meet armoured ships; or as *protected cruisers*. The very first duty the Class is required to perform is to relieve the *Bellerophon* as the flag-ship on the North American Station. I am therefore almost called upon to compare the two ships, and I believe I am sufficiently alive to the good points in both to be able to compare them impartially, so far at least as they can be compared, without either having undergone the stress of war. The two ships are fairly comparable, for they are about the same size, carry the same crew, and cost about the same money. It is sometimes supposed that the *Nelson* is a type in which armour is greatly reduced in amount. This is not so. It is reduced in extent, but the average thickness is greater, and the total weight is greater in the *Nelson* than it is in the *Bellerophon*. Covering-in the entire battery of the *Bellerophon* with armour, and extending the armour to the extremities of the water line, makes it necessary to be content with an average thickness of the vertical armour throughout the ship of 5·28 inches; whereas in the *Nelson* the average thickness of the vertical armour is 7·28 inches. So far, therefore, as there is an attempt to protect with armour, the average thickness of the protection will be nearly 38 per cent. more than that in the *Bellerophon*. I do not compare the squares of these thicknesses in the usual way, as representing the relative strengths, because for the greater portion of the blows received from shells in action the thinner armour will probably be impenetrable. The armour is suppressed at the ends of the ship, and an underwater deck is substituted for it. Beneath this deck aft, is situated the steering gear and the rudder-head, so that it is far more secure than it is in the *Bellerophon*, where it is all above water, concealed from view, and protected by thin armour, as in usual in belted ships. I do not attach special importance in this comparison to the twin screws of the *Nelson* against the single screw of the *Bellerophon*, although, I suppose, we are all agreed that in action the double propeller, the alternative mode of steering, and the power of turning without advancing are of great value. This came out in a most marked manner in the combat between the *Huascar* and the Chilian ships of war. The *Bellerophon* has greatly the advantage in the weight of the broadside fired from protected guns, and in the fact that, except at the ports, the battery walls are protected against the perforation of most shells, while the central part of the *Nelson's* armament is exposed to the entrance of any projectiles which could get through an inch plate. But the *Nelson* is much the more heavily-armed ship; the total weight of the armament being, *Bellerophon* 420 tons, *Nelson* 533 tons. The power of the *Nelson* in the right-ahead and right-astern attack, both offensively and defensively, is also greatly superior to that of earlier ships. The *Northampton* carries comfortably two 60-feet torpedo boats of sixteen knots speed, in addition to the service of boats required in a flag-ship. The total weight of the boats carried is nearly 40 tons.

Regarding the class as designed for cruising, it is to be observed that, with 4000 horses, say two-thirds power, the ship goes in smooth water 12¾ knots. With average coal she may therefore steam at an average ocean speed of 12½ knots, with a consumption for all purposes of 100 tons per day. For twelve days at this speed the distance covered would be, without the use of sail, say 3500 knots. With 2,300 horse-power she obtained in smooth water a speed of 10·537 knots, so that, with 60 tons per day, she would make a 10½ knots average ocean-speed, and should steam 5000 knots. I am fully sensible of the large consumption of fuel for a given speed as compared with the long narrow merchant ship, and of the corresponding loss in coal endurance; but it is always necessary to remember that the ship of war is endowed with a powerful rig, enabling her to cruise under sail for any length of time with no appreciable consumption of fuel, whereas the merchant steamship is helpless under canvas—she can only drift before the wind. To show the difference in the distribution of the weights in such a ship as the *Nelson*, and a first-class passenger steamer of the same displacement and designed for the same average ocean-going speed, 12 to 12½ knots, I have placed them side by side in the following table:—

	Nelson. Tons.		Passenger Ship. Tons.
Hull	3017	..	3200
Propelling machinery ..	1030	..	700
Armour	1720	..	—
Armament	533	..	—
Rigging, stores and equipment	633	..	450
Coal	1200	..	3750
	8133		8100
Consumption per hour at 12 to 12½ knots average speed	4	..	3

The gain in consumption in favour of the merchant ship is due to the fact that the speed is obtained in her with less engine power, because her proportions are more favourable to speed, and especially to ocean speeds. The length of the *Nelson* is only 4⅔ times the breadth, while that of the merchant ship is ten times, her length being 420 feet and her breadth only 42 feet.

	Nelson.	*Northampton.*	*Bellerophon.*	*Iron Duke.*
Length	280 feet	—	300 feet	280 feet
Breadth	60 feet	—	56 feet	54 feet
Mean draught of water	24 feet 7 inches	25 feet	24 feet 8 inches	22 feet 8 inches
Displacement	7473 tons	7652 tons	7550 tons	6010 tons
Indicated power of engines	6624 (twin screw)	6073	6520 (single screw)	4020 (twin screw)
Speed on mile at normal draught	14 knots	13·173 knots	14·17 knots	12·83 knots
Weight of protective plating and backing ..	1720 tons	—	1273 tons	1082 tons
Average thickness of vertical armour ..	7·28 inch	—	5·28 inches	5·77 inches
Weight of armament	533 tons	—	420 tons	351 tons
Weight of projectiles in a broadside ..	1800 lb.	—	1595 lb.	1378 lb.
Weight of projectiles thrown right ahead ..	800 lb.	—	230 lb.	628 lb.
Weight of projectiles thrown right astern ..	800 lb.	—	115 lb.	628 lb.
Cubic feet of space per gun in enclosed midship batteries	6000	—	3200	4000
Coal-carrying capacity	1200 tons	—	645 tons	460 tons
Area of canvas in plain sail	24,770 square feet	—	23,400 square feet	22,750 square feet

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* Read at the Twenty-first Session of the Institution of Naval Architects, 18th March, 1880.

FORM OF RIVETED JOINTS.*

(Continued from page 204.)

(II.) STRAINING ACTION ON RIVETED JOINTS.

A RIVETED joint is in a certain sense an imperfect part of a structure. It cannot be so designed as to be throughout uniformly strained. It has always certain surfaces markedly weaker than the rest, at which consequently deterioration of the material or fracture by the action of the load is liable to occur. These surfaces of weakness are so related that in general the increase of one involves a diminution of the other. The joint, therefore, which will carry the greatest load before fracture will be that in which the stress reaches the breaking limit for each of these surfaces simultaneously. Since the rivet section can in general be increased only at the expense of the plate section, in the strongest joint the rivet and plate will reach their breaking point under the same load. It would seem, therefore, that the proportions of a riveted joint could be determined by the ordinary rules of applied mechanics without the need of experiment. That this is not so is probably mainly due to a second condition of imperfection in riveted joints. To apply the ordinary rules for the strength of materials to riveted joints, it is necessary that the distribution of the stresses on the surfaces of weakness should be known. If those stresses were as uniformly distributed as in an ordinary bar tested for tension or shearing, the problem would be simple. But in fact the stresses are less uniformly distributed, and the law of their distribution is unknown. Consequently the average stress on the surface of fracture of a riveted joint, when broken by a load, is less than it would be if the stress were uniformly distributed, and needs to be determined by special experiments. Further, it may be different for different forms of joint. This average stress, always less than the maximum stress which causes fracture, is here termed the apparent breaking stress. Hence the chief object of experiments on riveted joints is to determine the apparent breaking stresses, (1) for the different surfaces at which each joint may fracture, (2) for the different forms of joints.

In certain cases allowance may have to be made for progressive deterioration of a joint, by corrosion or otherwise, which reduces the strength in certain directions more than in others. No experiments showing the amount of deterioration in such cases appear to have been made.

Tenacity of Material.—Let a bar be broken at the plane $a\,b$ of area ω (fig. 1) by a tension T acting normally to the section.

Then if the stress is uniformly distributed over the section at the moment of fracture, the ratio $\frac{T}{\omega}$ is the real tenacity of the material. But if it is not uniformly distribution, then $\frac{T}{\omega}$ is the only apparent tenacity; and this may be less than the real tenacity to any extent whatever. It may be useful to consider under what conditions the distribution of stress necessarily becomes unequal.

(1) It will cease to be uniform if the resultant P of the load does not pass through the centre of figure of the section. Thus in the case shown in fig. 2 the stress is a varying stress, which however varies regularly so long as the limit of elasticity is not passed. Some of the discrepancies in the results of experiments on riveted joints are probably due to want of care in ensuring the coincidence of the line of action of the load with the centre line of the joint, in the plane parallel to the surface of the plates. Fig. 2 *a* shows how unequal distribution of stress may arise from this cause. In the plane at right angles to this there is probably always deviation of the load from the centre of figure. In lap joints the load has to be transmitted from one plate through the rivet to the other plate; in butt joints from one plate through the rivets to the cover strip and back to the other plate. In both cases, and especially in the former case, the eccentricity of the load appears to cause a reduction of strength.

Fig. 1.

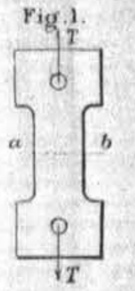


Fig. 2

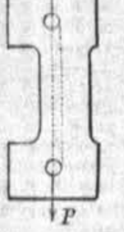


Fig. 2a.

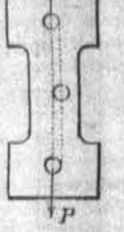
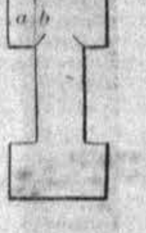


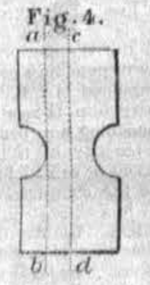
Fig. 3



(2) The stress may be rendered unequal by the local action of contiguous material. Thus a bar with square corners (fig. 3) is known to break with a low apparent tenacity. The unstrained material at *a* prevents the elongation of the contiguous material at *b*, which consequently gets an excessive proportion of the load, and the fracture begins at the corners.

Now in the portion of metal between two rivet holes a similar action probably occurs. The outside fibre *a b* (fig. 4) has less freedom of elongation than the central fibre *c d*, because it is attached to the comparatively unstrained material behind the rivet. Hence, instead of breaking simultaneously over the whole section, fracture probably begins at the edges of the hole, and proceeds because the reduction of area causes increase of stress in the part remaining unbroken. This is sometimes shown by the fact that the parts of the plate will not fit after fracture. There appears to be a slight reduction of strength in plates with a hole drilled in them as compared with solid plates, and this is probably due to the cause now under consideration. It is also probable that this reduction of strength may really be greater than appears in these experiments. Short bars are known to give a higher average tenacity than long bars. Now a bar with a hole drilled in it is virtually a very short bar, and it ought therefore, if there were no cause of diminution of strength, to show a higher tenacity than ordinary test bars. But in fact there is generally a loss of strength.*

Fig. 4.



(3) If the material in the neighbourhood of the surface of

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* Reports to Research Committees of the Institution of Mechanical Engineers.

* In some experiments there is a curious apparent increase of strength after drilling. Thus in one of Mr. Stoney's experiments the drilled plate was 7¾ per cent. stronger than the undrilled plate. In some experiments by Mr. Parker the plain plate carried 26·4 tons, while a plate punched and annealed carried 31·7 tons. See also the Table of treble-riveted joints given further on. Mr. Adamson also finds that the tenacity through a line of drilled holes is a little greater than the tenacity of the plate before drilling. Discrepancies of this kind may be due to the holes causing fracture at a section stronger per square inch than other parts of the plate. An ordinary test bar breaks at the weakest part of a more or less considerable length of bar.

fracture is initially (before the application of the load) in an irregularly strained condition, or has in different parts unequal power of elongating, then the stress will not be uniform at the moment of fracture, and the apparent tenacity will be less than the real tenacity. This is the cause of the loss of strength due to punching. By the action of the punch metal is caused to flow laterally into the surrounding metal. This induces initial stresses in an annulus of metal round the hole, and very probably also, as M. Barba thinks, alters its power of elongation. If the power of elongating is diminished in part of the metal, that part gets an excessive proportion of the load, and breaks before the rest is fully strained. The result of either loss of tenacity or loss of ductility is to diminish the apparent tenacity of the metal to an extent which certainly reaches in some cases 20 to 30 per cent. Fig. 5 shows a possible condition of the bar after punching, the ordinates of the dotted curves representing the stresses. Immediately round the hole is an annulus in which the stress is compressive, the compression being due to material forced in. To balance the forces in this ring, an annulus in which the stress is tension must surround it.

In some experiments there appears to occur a serious diminution of the apparent tenacity in riveted joints when the bearing surface of the rivets on the plates is too small, and when consequently the crushing pressure between the rivet and plate is excessive. It is possible that this is due to an action like that which occurs in punching. The pressure of the rivet may cause a lateral flow of the metal, and alter either the stress or the elasticity of a ring of metal round it. The stress on the tearing section being then unequal, a low apparent tenacity is found.

(III.) EXPERIMENTS TO DETERMINE DIRECTLY THE BREAKING STRESS.

Tenacity of Iron and Steel Plates.—The following are the principal values of the tenacity of iron and steel in the memoirs of which abstracts have been made :—

IRON.

TENACITY, Tons per square inch.

	With Fibre.	Across Fibre.
Fairbairn	22·5	23·0
Clarke	24·0	
Roberts (Baldwin's Paper)	17·92	
Parker (Best Best)	23·3	
Stoney	18·54	
,,	22·00	
,,	21·43	
,,	24·00	
Fletcher	21·19	
Easton and Anderson	18·7	14·0
,, ,,	21·5	20·5
Barnaby	21·5	
Greig and Eyth	22·27	

STEEL.

Riley	31·20	31·25	Unannealed.
,,	28·85	28·78	Annealed.
Kirk	28·34		
Boyd	28·7		
Parker	27·89		
Martell	28·93		
Barnaby, open hearth	27·6		
,, Converter	27·5		
Greig and Eyth	25·83		

Where the direction of fracture is not stated, it is assumed that the load was applied in the direction of the fibres. The tenacity of iron is on the average ten per cent. less in a plane perpendicular to the direction of rolling, than in a plane parallel to the direction of rolling: with steel there is no sensible difference.

Apparent Tenacity of Drilled and Punched Plates.—The apparent tenacity of punched and drilled plates must be obtained from experiments on single plates with one or more holes in the line of fracture. In experiments on riveted joints there is a certain amount of bending and crushing action, and the diminution of tenacity is greater than that due simply to punching or drilling. Two experimenters, Mr. Cochrane and Mr. Riley, the former testing Lowmoor and ordinary iron, the latter Landore steel, have found that neither punching nor drilling had any sensible effect in altering the tenacity of the metal. In the latter case holes were punched or drilled in the edge of a strip. Probably in that case the compressive action is less than when a hole is made in a wide strip, and consequently the injury to the plate is less. In Mr. Cochrane's experiments the strip was so narrow that it could expand laterally under the action of the punch. The right method in making such experiments would seem to be to form the holes in a wide plate, which is afterwards cut into strips suitable for experiment.

Mr. Stoney has found in three iron plates with drilled holes, a diminution of from 2·6 to 9·2 per cent. of tenacity, and in one plate an increase of 7·5 per cent. Average loss 2·05 per cent.

Mr. Kirk gives some experiments showing that iron and steel plates with drilled holes are stronger than with punched holes; but he does not give the tenacity of the undrilled plate. With a thinner steel plate, ¼ inch thick, he appears to have obtained the following results :—

TENACITY.

	Unannealed.	Annealed.
Undrilled plate	29·74	29·30
Drilled plate	29·50	28·45
Drilled each side	—	29.50

Mr. Boyd found in steel plates a loss of 2·15 per cent. due to drilling. Mr. Martell found no appreciable loss. The remarkable results obtained by Mr. Adamson and already commented on should be compared with the results here given.

Putting aside the experiments mentioned above, all other experiments show a considerable diminution of tenacity in both iron and steel plates due to punching. In Mr. Barnaby's earlier experiments the loss is exceptionally large, and it is possible that the sides of the plate were sheared in his experiments as well as the holes punched.

In M. Barba's experiments the proportionate loss of tenacity increases as the ratio of width of plate to diameter of hole increases. It may be presumed that this is due to the narrow strips yielding more in width than wide ones under the action of the punch. But this yielding could not occur with ordinary plates, and it is doubtful therefore if M. Barba's experiments afford a satisfactory measure of the loss of strength in punching wide plates. Mr. Kirk proceeded in a more satisfactory manner, punching a wide strip and then slotting it into strips suitable for experiment.

EXPERIMENTS ON TENACITY OF PUNCHED IRON PLATES.

Authority.	Thickness of plate. Inches.	Width of plate. Inches.	Number of holes.	Diameter of holes. Inches.	Tenacity.	Loss of tenacity in per cent. of original strength.
Barnaby	0·625	2¼	—	0·875	16·4	
,,	0·375	2	—	0·75	17·45	
,,	0·375	2	—	0·75	16·66	
Stoney	0·375	3	1	0·75	15·4	15·6 Mean 11·45
,,	0·375	4	2	0·875	19·24	10·2
,,	0·375	8	5	0·875	22·22	7·4
,,	0·375	8	5	0·875	21·97	12·6
Fletcher	—	—	—	—	20·15	5
Kirk	1·15	—	1	1·18	15·27*	18
,,	1·16	—	1	1·18	15·95*	
,,	1·17	—	1	1·22	16·81†	8
,,	1·16	—	1	1·22	17·02†	
Martell	0·8	—	—	—	—	20 to 23
Barba	—	1·24	1	0·66	16·81	5
,,	—	1·95	1	0·66	16·69	5½
,,	—	2·62	1	0·66	15·10	14
,,	—	3·35	1	0·66	14·72	17
,,	—	4·05	1	0·66	14·79	16
Maynard	—	—	—	—	—	19‡
Barnaby ,, ,,	0·54 to 0·75	2·8 to 3·3	2	1·00	19·0	11§§
,,	,,	,,	,,	,,	17·7	17**
Parker	0·74	4·0	1	1·1 & 1·17	18·19	18·8
,,	0·74	4·0	1	1·1 & 1·32	18·93	

* Hole in die-block ⅛ in. larger in diameter than punch.
† Hole in die-block ¼ in. larger in diameter than punch.
‡ This is loss of punched as compared with drilled plate.
§§ Punched before shaping. ** Punched after shaping.

EXPERIMENTS ON TENACITY OF PUNCHED STEEL PLATES.

	Thickness of plate. Inches.	Width of plate. Inches.	Number of holes.	Diameter of holes. Inches.	Tenacity.	Loss of tenacity in per cent. of original strength.
Barnaby	0·625	2¼	1	0·875	14·5	
,,	0·375	2	1	0·75	18·54	
Wilson	0·375	2	1	0·75	22·08	23
Kirk	0·75	—	1	1·02	17·96*	33
,,	0·75	—	1	1·02	11·18*	
,,	0·75	—	1	1·05	23·21†	19
,,	0·75	—	1	1·05	20·40†	
,,	0·25	—	1	0·75	29·10	2
Boyd	—	—	—	—	—	51
,,	—	—	—	—	—	35
,,	—	—	—	—	21·15	31
Martell	0·8	—	—	—	—	22 to 33
Barba	0·27	1·24	1	0·66	26·98‡	
,,	0·27	1·95	1	0·66	26·11‡	
,,	0·27	2·65	1	0·66	24·39‡	
,,	0·27	3·35	1	0·66	23·09‡	
,,	0·27	4·05	1	0·66	23·88‡	
,,	0·27	4·75	1	0·66	23·31‡	
,,	0·27	1·24	1	0·66	31·95§	
,,	0·27	1·95	1	0·66	27·85§	
,,	0·27	2·65	1	0·66	25·25§	
,,	0·27	3·35	1	0·66	23·27§	
,,	0·27	4·05	1	0·66	23·57§	
,,	0·27	4·75	1	0·66	23·98§	
B'rnaby (Open-hearth.	0·6 to 0·7	2·9 to 3·3	2	0·875 to 1	23·7	13§§
,,	,,	,,	,,	,,	24·5	11**
B'rnaby Con-verter.	0·54 to 0·72	,,	2	0·875 to 1	21·7	21§§
,,	,,	,,	,,	,,	24·8	9**
Parker††	0·687	4·0	Semi-hole at each edge	1⅛ & 1$\frac{3}{16}$	22·92	17·8
,,	0·7	4·26	1	1·1 & 1·35	24·46	12·3
,,	0·7	4·26	1	1·0 & 1·35	21·04	24·5
,,	0·75	—	2	1·09&1·11	20·00	24·2
,,	0·75	—	2	1·08&1·24	18·69	28·7
,,	0·75	8¼	2	1·09&1·19	20·50	30·0
,,	0·75	8¼	2	1·09&1·22	19·08	
,,	0·25	—	2	0·69&0·74	29·48	8·1
,,	0·375	—	2	0·84&0·94	24·06	18·7
,,	0·468	—	2	0·97&1·11	21·38	26·2
,,	0·593	—	2	0·96&1·1	19·57	33·8
,,	0·75	—	?	1½	19·80	33·0

* Hole in die-block $\frac{1}{16}$ in. larger than punch. † Hole in die-block ⅛ in. larger than punch. ‡ Cylindrical punching. Hole in die 0·76 in. diameter. § Conical punching. Hole in die 0·82 in. diameter. §§ Punched after shaping. ** Punched before shaping. †† The two dimensions in fifth column for these experiments are diameters of punch and hole in die-block.

These experiments cannot but be regarded as extremely discordant both for iron and steel, and they do not afford any adequate guide in predicting the probable loss of tenacity due to punching in different cases. But they show that loss depends on the following circumstances :—(1) The material; (2) the diameter of the punch, or probably the ratio of diameter of punch to thickness of plates; (3) the width of metal round the hole, or probably the ratio of diameter of punch to pitch of riveting; (4) the ratio of diameter of punch to diameter of hole in die-block. If further experiments on this subject were made, it would seem most desirable to select extremely uniform qualities of iron and steel, so that a few experiments only should be necessary to obtain average values. Further, it would seem extremely desirable not to confine the experiments to strips with a single hole. Mr. Stoney's experiments, in which some test bars had five punched holes, rather seem to indicate that the proportionate loss is greatest in bars with only one hole.

In an experiment by Mr. Adamson the strength was increased by driving a pin into the hole, so as to prevent the metal round the hole from collapsing into an elliptical shape. As the holes in riveted joints are in this condition, it would be desirable to repeat this experiment.

In a simple experiment by Mr. Sterne, it appeared that a spiral punch injured the material less than an ordinary punch to the extent of about 7 or 8 per cent.

Apparent Tenacity of Annealed and Rimered Plates.—All the experiments indicate a complete restoration of the original tenacity of the iron or steel, if the plate is annealed after punching, or if a narrow ring 0·04 inches, to 0·08 inches wide is rimered out of the punched hole. These processes, by removing straining action or by removing the strained metal, bring back the bar to the condition of a bar with drilled holes. In a few experiments, the material appears to gain a little in strength by annealing.

Apparent Shearing Resistance of Rivet Iron and Steel.—The true shearing resistance of the rivets cannot be ascertained from experiments on riveted joints, (1) because the uniform distribution of the load to all the rivets cannot be ensured; (2) because the friction of the plates, which has the effect of increasing the apparent resistance to shearing, is an element uncertain in amount. Probably in the case of single-riveted joints the shearing resistance is not much affected by the friction; but for the present attention will be confined to special experiments on shearing.

	Ultimate Shearing Stress in tons per square inch.	
Iron, single shear (12 bars)	24·15	Clarke.
,, double shear (8 bars)	22·10	
,, ,, ,, ,,	22·62	Barnaby.
,, ,, ,, ,,	22·30	Rankine.*
,, ¾ inch rivets	23·05 to 25·57	Riley.
,, ⅞ inch ,,	24·32 to 27·94	
,, mean value	25·0	
,, ⅝ inch rivets	19·01	Greig and Eyth.
Steel ,, ,,	17 to 26	Parker.
Landore steel, ¾ inch rivets	31·67 to 33·69	Riley.
,, ,, ⅞ inch ,,	30·45 to 35·73	
,, ,, mean value	32·3	
Brown's steel	22·18	Greig and Eyth.

* Deduced from Doyne's experiments.

Fairbairn's experiments show that a rivet is 6½ per cent. weaker in a drilled than in a punched hole. By rounding the edge of the rivet hole the apparent shearing resistance is increased 12 per cent. Mr. Maynard found the rivets 4 per cent. weaker in drilled holes than in punched holes. But these results were obtained with riveted joints, and not by direct experiments on shearing. It must be remembered that there is a good deal of difficulty in determining the true diameter of a punched hole, and it is doubtful whether in these experiments the diameter was very accurately ascertained. Messrs. Greig and Eyth's experiments also indicate a greater resistance of the rivets in punched holes than in drilled holes.

If, as appears above, the apparent shearing resistance is less for double than for single shear, it is probably due to unequal distribution of the stress on the two rivet sections. The shearing resistance of a bar, when sheared in circumstances which prevent friction, is usually less than the tenacity of the bar.

The following results, which are perhaps not all that could be found, show the decrease.

	Tenacity of Bar.	Shearing Resistance.	Ratio.
Harkort, Iron	26·4	16·5	0·62
Lavalley, Iron	25·4	20·2	0·79
Greig and Eyth, Iron	22·2	19·0	0·85
,, Steel	28·8	22·1	0·77

In Wöhler's researches (in 1870) the shearing strength of iron was found to be $\frac{4}{5}$ of the tenacity. Later researches of Bauschinger confirm this result generally, but they show that for iron the ratio of the shearing resistance and tenacity depends on the direction of the stress relatively to the direction of rolling. The above ratio is valid only if the shear is in a plane perpendicular to the direction of rolling, and if the tension is applied parallel to the direction of rolling. The shearing resistance in a plane parallel to the direction of rolling is different from that in a plane perpendicular to that direction, and again differs according as the plane of shear is perpendicular or parallel to the breath of the bar. In the former case the resistance is 18 to 20 per cent. greater than in a plane perpendicular to the fibres, or is equal to the tenacity. In the latter case it is only half as great as in a perpendicular to the fibres.*

(*To be continued.*)

STEEL IN THE SHIPBUILDING YARD.

By WILLIAM DENNY.†

I PURPOSE, in the following paper, to state as shortly as possible some of the experience my firm have had in the use of mild steel during the last two years. We first used steel during the blockade-running period, and introduced it into some portions of paddle steamers we built for blockade-running purposes. The material as then made was far from satisfactory, and its behaviour did not encourage us to extend its use. In 1876 we made our first acquaintance with the mild steel now in use, when we built for the Irrawaddy Flotilla Company a light-draught paddle steamer called the *Taeping*. All the skin and stringer plates of this vessel were of Bessemer steel, the rivets being of iron. We had perfect satisfaction in the working of this material, and the steamer after being put together in Rangoon fully evidenced the value of steel for vessels of her type. On one of her earliest trips she struck on a snag in the Upper Irrawaddy, but came off safe and sound, her plating heavily indented but unbroken. We were informed by the superintendent engineer of the company he was of opinion that if she had been of iron she would have gone down under the circumstances. Since the building of the *Taeping* we have gone largely into the use of steel, and at present have little else in our yard. This paper covers the period following our building the *Taeping*, and the steel now referred to is entirely of the Siemens-Martin description. We did not select this kind of steel or specify it, but fell into the use of it from the fact that it was most frequently offered us, and that most of the steelworks employed in producing shipbuilding material work upon this principle. All the sea-going steamers we have launched till now *have been* built of steel produced by the Steel Company of Scotland, while the steel for the light-draught steamers was made by the Steel Company, the Landore Company and the Butterley Company. Of the steel supplied to us we have had very little reason to complain, indeed our only real ground of complaint has been the uncertainty of its delivery—a fault arising probably from the newness of the works, but none the less vexatious and serious. Unless the various steel works improve in this particular they will seriously damage their own prospects, and a word of warning upon the point may not be amiss to them. In our latest contracts we have returned to iron for no other reason than our dread of seeing our yard disorganised through the bad deliveries of material. The method of testing adopted by Lloyd's has also greatly aggravated the effects of the bad deliveries, and will be referred to further on.

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* Muller. Beitrage zu der Vernietung eiserner Brücken.

† Read at the Twenty-first Session of the Institution of Naval Architects, 19th March, 1880.

Regarding the behaviour of the steel in working, I cannot do better than quote from a letter we addressed to Mr. Waymouth on the 28th of last month, in reply to an enquiry made by him on behalf of Lloyd's Committee, for information upon this subject. In this my firm said:—"With reference to failures in manipulation, we have very few cases to report, although we have kept a note of them. We divide these failures into failures of plates and failures of bars. The first failures of plates we noticed were in the case of four of the flanged plates forming the bilge-keels of No. 224. These four plates, after they were screwed up, developed small cracks through some of the rivet holes piercing the flanges attaching the plates to the ship's bilge. We discovered that these cracks were due to our workmen having finished the plates at a black heat. We removed them, cut out the defective portions, welded in fresh pieces, annealed the plates as a whole and replaced them. In No. 226, which had a plate keel, the aftermost length, which was bent to the form of the keel of the stern frame, developed a small split in the extreme end. The length of plate permitted the split portion to be cut off. The plate otherwise was found perfectly good, and was used in the steamer. One of the flat keel plates of this steamer, after being finished, was heated to a cherry red and laid down for cooling; while cooling it bent up in the middle, and was hammered down from the top side. On being examined, a fracture was found on the under side about 6 inches from the end, and the plate was rejected. These are all the failures we have to report in our working of steel plates, and without exception they can, as you will notice, be readily traced to the working of the material at a black heat. This is the really unsafe thing to do with steel, and our foremen and men have now received instructions that it is not to be attempted, and that if a piece cannot be finished at a red heat it must be completely reheated or finished cold. In bars we have to report no failures in the working of either the ordinary bulbs or Butterley sections, and the welded knees on the beams have in no case shown any defect, which they might have been expected to do, if at all, in being riveted to the frames. In angles we have had one boss frame which cracked on the deep flange at the outermost portion of the boss shape. This was evidently due to the workmen laying this flange down at black heat. In our light-draught work, where we have short pieces of angles correct in the centre to form doubling pieces over the limber holes—we have had one or two cases of the outer edge of the flange tearing slightly while being cressed at a red heat, but no case of breaking. We think that, considering the failures above noted are all that we have to report out of a consumption of about 7000 tons of steel, they are very far from being of serious moment. We can point to no similar experience in the use of iron; indeed, in a small steamer we have now building of that material, we have had to reject for failure under manipulation more plates than the total number of failures now reported to you. We may remark that 6 inch by 3 inch frames, which we are working in steel for Nos. 237, 238, and 239, have not as yet produced a single failure or crack. Iron frames of similar dimensions in a steamer we built some years ago, manufactured by one of the best Scotch makers, gave us a very considerable amount of trouble from cracking on the inner edge of the deep flange in riveting them round the bilge. We believe, if a careful record were kept of the behaviour of ordinary shipbuilding iron under manipulation as compared with the behaviour of steel under manipulation, many people would be surprised to find the tables completely turned in the matter of unreliability, and that enormously to the disadvantage of iron. We had the pleasure of bringing under your notice some time ago a good illustration of this, in the behaviour of the pieces of our light-draught steamers under shipment, comparing those built of iron with those built of steel."

The letter referred to in the last part of the foregoing quotation described the behaviour under shipment of the pieces of light-draught steamers built of steel, as compared with that of pieces of similar steamers built of iron. We had before 1878 built a considerable number of these vessels in iron. They were put together in the yard and then shipped to Glasgow in lighters, from which they were transhipped on board steamers going to the East. During this shipment and transhipment we were invariably annoyed more or less by corners of plates coming off, angle irons cracking, floors breaking, and such little mishaps. Last year we built and shipped six steel paddle steamers of various sizes, varying from 250 feet to 80 feet long, without losing anything by breakages. These vessels were entirely of steel and steel riveted, and I think that, as a rough practical test, nothing can more effectively prove the general reliability of steel as compared with the unreliability of iron than this. Indeed, our whole experience leads us to reverse the ideas largely held regarding steel and iron, and to look with confidence on the steel, and doubt on the iron. Our foremen and workmen hold this view of the matter very strongly, and speak most contemptuously of going back to iron. Their confidence in the power of steel to do everything and stand everything, excepting working at a black heat, is of the firmest nature, and it will be acknowledged such confidence cannot be causeless.

In addition to the regular testing carried out by us for Lloyd's, and also for the light-draught work we generally have in hand, we have made some experimental tests, a few of which I wish to bring under your notice, and in doing so I must acknowledge the very considerable assistance and valuable advice afforded us by Mr. William John, also the readiness with which Mr. Mumford, our local Lloyd's surveyor, entered into these experiments, and the desire shown by him to take interest and give assistance in all test experiments, even over and above his regular duties. Among the earliest experiments made by us was a series of tests intended to find out whether rapidity in breaking the pieces under tensile strain affected their results disadvantageously. The inquiry was forced upon us by objections taken to rapid testing, and its results very much surprised us. They are shown in Tables I. and II.* The time was taken by a chronograph, started whenever the lever of the testing machine floated, and stopped when the piece broke. Table I. shows the results afforded by a plate of a hard nature. From this plate twelve test-pieces were prepared—one half of them being tested as rapidly as possible, and the other half slowly. You will notice that the first series, broken in an average time of about a minute and a half, show an average of 40·63 tons of tensile strength, and 11·96 per cent. extension. The second series, broken in an average time of eleven minutes fifty seconds, show a mean tensile strength of 39·86 tons and 11·48 per cent. of extension. The difference is hardly worthy of mention.

In Table II. a similar set of experiments are shown, carried out on a mild plate, and at three different rates of speed. Practically, no difference is shown in the results. Both sets of experiments hint at a slightly less extension tested slowly than quickly. In the first series of the first set, Nos. 3 and 4 are peculiarly noteworthy as being broken under a minute. Yet the mean of their percentages of extension is little affected, and the lowest is no lower than No. 4 of the second series, broken in ten minutes fifty seconds. In considering this it is worthy of remark that, to break the pieces in less than a minute, the hydraulic pump had to be worked full swing, throwing shock after shock on the machine, as was made evident by the violent vibrations of the test lever. From these results, I think, it may be assumed the time element, unless widely extended, is of little effect in the practical testing of steel.

Another set of experiments is shown in Tables III., IV. and V., and refer to the effects of simple annealing. Eight test pieces were cut from each of two quarter-inch plates, one known to be hard and one known to be very soft. After being prepared in the usual way, one half of each set of pieces was carefully annealed. In the hard plate we have a mean tensile strength unannealed of 32·97 tons, and a mean percentage of extension of 16·65. The annealing reduced the mean tensile strength to 28·52 tons, or by 13·5 per cent., and raised the percentage of extension from 16·65 per cent. to 24·12 per cent., or by 45 per cent. The soft plate showed unannealed 26·6 tons mean tensile strength, and 24·32 per cent mean extension. Annealing lowered the tensile strength to 24·05 tons, or by 9·6 per cent., and raised the extension to 29·8 per cent.—22·6 per cent. of a rise. It is curious that the hard plate, although decreased in strength and increased in extension by annealing, showed no improvement in the bending test due to annealing. A similar set of experiments is shown carried out in Table V., upon a ½-inch plate of mild nature. The decrease in tensile strength shown here is not more than 5·6 per cent., and the increase in percentage of extension does not exceed 7·3 per cent., the annealing being evidently less powerful for change in thick than in thin plates; however this may be, there are apparently two lessons to be learnt from the foregoing experiments, and these are, that hard plates may be brought within desired limits of strength by simple annealing, and that soft plates may be injuriously reduced by the process. This latter is a matter of serious moment, especially when we are, as now, dealing with steel of light tensile strength. If plates of 29 tons average strength are to be annealed, and thereby reduced to 26 tons, it is evident we shall end in working with a material in many parts of a ship of less strength than assumed in our calculations. On this account my firm have preferred the practice of rimelling punched holes, where such was required, to annealing the plates. The rimelling removes any bad effects of punching, and without lowering the general strength of the plate, which the annealing unquestionably does.

In connection with this matter of annealing, there very early arose a point with regard to to the beam-knees of the steamers we were building, as to whether we should not anneal after finishing them. These beam-knees are split and welded in several heats, and Lloyd's authorities expressed some doubts as to whether it would be prudent to pass them without annealing as a whole. For a considerable time, therefore, we were in the habit of annealing the beam ends, but latterly we have not done so, and have had no cause to regret the change. Before making it we carried out a series of experiments on welded beam-knees, both of the common bulb and Butterley sections. Some were annealed entirely, some in the knees only, and some unannealed. They were all subjected to a similar and very rough treatment, the knees being bent round flat on the beam, and the end of the knee doubled in upon it. No difference could be discovered between the behaviour of the different specimens; if anything, the completely unannealed beams having rather the best of it.

In Mr. Martell's Paper on Steel for Shipbuilding, he mentioned some successful attempts made by Mr. A. C. Kirk to shingle the scrap of mild steel into forgings. Mr. Kirk has, I believe, since that time continued to push this matter, and with considerable success. Following him, we have gone largely in for scrap-steel forgings. Our practice commenced by making the stems of all the sea-going steel steamers we built of scrap steel. At the same time we made the stems, sternposts, and rudders of all our light-draught steamers of the same material; and as success followed each fresh attempt we pushed further on, till now all three of the sea-going steel steamers we have on the stocks are to have all their forgings, stems, stern-frames and rudders of the same material. We have now in place one of these stern frames weighing 9 tons. Before, however, going this length, we thought it prudent to carry out some experiments upon the material, comparing it with ordinary iron scrap forgings. The results are before you in Tables VI. and VII. For the purposes of comparison, two blooms were forged out of common scrap-iron, and two out of scrap steel, and both worked down under the hammer into flat slabs resembling plates about ¾ inch thick. From each of these, three pieces were cut for tensile tests and two for deflection tests. You will notice that in the tensile tests the scrap steel shows a mean tensile strength of 23·8 tons, and a mean extension of 19·5 per cent. against 20·6 tons, and 14·9 per cent. of extension in the iron plates, a decided gain, although not so decided as the difference between an original steel and iron plate. The individual tests also agree better together in the steel than in the iron scrap forgings. Under deflection we have, at 5000 lb. strain, the iron with a mean deflection of fully 50 per cent. more than the steel, and at 8000 lb. with about one-third more. These results point to the very considerable superiority of forgings made from steel scrap over those made from iron scrap. Our forge people report no failures in the manipulation of the scrap steel. The men complain that it is tougher to work, but beyond this we have no complaint, and we have not as yet had to reject any of the forgings, or to find fault with them. A steamer we lately built for New Zealand, having engines of 1600 indicated horse-power, had both piston-rods of scrap steel. They worked most satisfactorily, and the ship is now running on her regular service.

Last year my partner, Mr. Brock, had occasion to have some experiments on riveted joints made by Mr. Kirkaldy. These joints were formed of steel plates, and riveted with steel rivets. In four cases complete shearing of the rivets took place, and these cases showed successively 19·4, 20·6, 19·2 and 19·8 tons shearing strength per square inch of rivet area, or a mean of roughly 20 tons. As the rivet bars from which these rivets were made had a tensile strength of 28·9 tons per square inch, this result not only astonished but rather disquieted us, and led us in our ship work to treble-rivet all our skin butts in the steel ships we were building for half the length amidships, completing all the rows, so as to bring the strength of rivet area up to the strength of the most heavily-punched part of the plate. The result was certainly widely divergent from that assumed to occur in iron where the shearing and tensile strength per square inch of area are supposed to be identical. We, therefore, commenced a double set of experiments, all with drilled rivet holes, and included in them, besides the comparison of iron and steel rivets, a further comparison as between hydraulic and hand-riveting, and as between scrap and homogeneous steel rivets. We also added to these a set of experiments on the effect of taking the sharp corner off the cutting edges of the rivet holes, to see whether this expedient would increase the shearing strength of the rivets. The results are shown in Tables VIII. and IX., and the combination of the two sets of tests in Table X. Regarding these, it may be remarked, that the hand-riveting shows much less regularity than the hydraulic, and is, on the whole, inferior to it. If we judge purely by the hydraulic riveting, we may assume that the scrap-steel rivets have about 21 per cent. more shearing strength than the iron rivets. The difference between the scrap and homogeneous steel is slight. Between the scrap-steel rivets and the iron ones 21 per cent. of a difference should, however, be sufficient to recommend the former, or rivets of homogeneous steel. If any action of a galvanic nature is set up between the steel plates and iron rivets, as has been suspected, a further reason for preference may be advanced. It may be asked why the steel rivets in Mr. Kirkaldy's tests sheared at a mean of nearly 20 tons per square inch, and those in the experiments now described at say 24½ tons. In the rivets tested by Mr. Kirkaldy the diameter was 1·13 inches, while in the rivets tested by us the diameter was ·82 inches, and it is possible the smaller size of rivet may, area for area, be better able to resist a shearing strain. It is also possible that shearing a single rivet may show more favourably than shearing a number. The blunting of the edges of the holes seems to have brought the hydraulic riveting from 23·3 to 24·3 tons, and the hand riveting from 21·6 to 24·3 tons shearing strain. Taking a fair view of the matter, I do not think it would be prudent to assume in ship riveting—which must in the most important part, the skin, be done by hand—a higher shearing strain than 22 tons per square inch of area, against say 19 tons for an iron rivet. Granting this, it would seem that a full reconsideration of the subject of riveting in steel is called for; and we should recognise that the same rules can hardly apply to a material which has a shearing strength of 22 tons, against a tensile strength of 29 tons, as apply to a material having the one 19 and the other 20 tons. We shall require proportionately more riveting in steel than in iron, and in the butts especially. For half the length amidships, I think, in any steel steamer of over 300 feet long, treble-chain riveted butts would be aprudent precaution from bilge to gunwale. Such riveting would also have a strong tendency to steady the butts of such thin material against local panting. The butt straps also should be made considerably thicker than the plates on this account.

One of the most important points in connection with steel is to get at some idea of the mean strength and elongation obtained in it under a given set of test conditions. To illustrate this there are shown in Table XI. the mean breaking strains of angles and bulbs, and plates, separately, as deduced from all the tests made (excluding rejections), for the four sea-going steamers we have built of steel to Lloyd's class. There is also shown the mean percentages of extension for each. Lloyd's conditions are that the tensile strength must not fall below 27 tons, nor exceed 31 tons per square inch, and that the percentage of extension on 8 inches must not fall below 20 per cent. The mean of Lloyd's limits of tensile strength is 29 tons, and, if you will look on the Tables before you, you will find only one instance in which the mean tensile strength of the plates falls below this, and only slightly. The angles and bulbs fall below the mean in two out of the four ships. The extensions are wonderfully even and good. Taking the mean tensile strength all over, it stands at about 29·137 tons, with a mean extension of 22·65 per cent. As a result in attempting to meet a given set of conditions, and to meet them at the same time safely and well, I think this worthy of a ready commendation; and the Steel Company of Scotland, the makers of all the steel used in these four steamers, certainly deserve credit for their success. Looked at, however, from a constructor's point of view, I am not so contented with the result. It would be rash to assume as a factor in our calculations for strains, from the results now laid before you, a higher tensile strength than 28 tons per square inch, and we must always remember that the annealed plates will probably drop from 2 to 2½ tons lower. In the face of this contingency I think Lloyd's have been only prudent in restricting the reduction of scantlings to an overhead of 20 per cent. But is it necessary we should restrict ourselves to such very mild steel? I think not. Till very lately my firm did so, but our last contract for steel for a large light-draught steamer had limits of tensile strength from 29 to 33 tons, and we only require an extension on 8 inches of 18 per cent. This increased strength in the steel will greatly help the rigidity of the steamer, and will not, I believe, be accompanied by any troublesome consequences. I believe it has been too readily assumed that steel of high tensile strength is unsuitable for shipbuilding. Anyway, unless we can work it we shall never reap the full benefit steel can confer. Would it not be possible, perhaps, while making the shell plates of a softer material as being more liable to collision, to make all the inner plating and framing of a harder and more rigid steel? Sometimes might in any case be done in raising the lower limit of tensile strength. The results put before you as to the test averages clearly show that the steel makers can work to close margins, and might be induced to work closer still. So far the development in mild steel has been in the direction of a steady rise of strength. The Admiralty, who took the lead in the matter, and who deserve the thanks of the country for their efforts and success in improving the manufacture, adopted 26 and 30 tons as limits. Lloyd's, following them, adopted 27 and 31 tons, and the Liverpool Underwriters 28 and 32 tons. I have no doubt further progress will be made in this direction, but it is possibly fortunate that we have advanced no further, seeing that we have yet to decide how we are going to butt, strap, and rivet such strong material. Till we settle this point satisfactorily we are as well to delay.

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* We are obliged to omit the tables for want of space. The results, however, are given by Mr. Denny in his paper. [ED.]

Regarding the future of steel, it seems to me that there are four matters of doubt and difficulty. The first of these has been already referred to, and is the poor delivery of material as yet attained by the various steel works. This is a matter which may be expected to mend with time and practice, but up to the present it has been by no means the least serious obstacle to an enlarged use of steel. The second matter is the aggravation of these bad deliveries by the practice of testing adopted by Lloyd's for shipbuilding material. This practice consists in testing in the yard after delivery of the material, and has been the source of exceeding annoyance, expense, and delay to builders using steel and classing at Lloyd's. It is condemned by the practice of our own and the French Admiralties, by the practice of the Liverpool Underwriters' Registry, and by the practice of Lloyd's Registry, in so far as boiler plates are concerned. It is also, I believe, condemned by every builder who has had the misfortune to suffer from it. Permit me to point out as shortly as possible the main objections to testing in the yards. The first is that it never can be as efficient as testing at the manufacturers' works upon the material as rolled, because there the surveyors can see a bending test made from each plate and bar as they are sheared or cut to length. It must also be remembered that tests can be enforced more rigidly, and will be accepted more willingly at the makers' works, upon small quantities than in the yards upon large quantities, made costly by carriage, and certain to be made more so by return carriage. A second objection is the useless expense thrown on builders of forming a testing staff, and erecting a machine or paying for the services of a public machine, when the necessary apparatus and staff already exist and act at the maker's works. A third objection is that the shipbuilding yard is turned into a storehouse for material which cannot be immediately used, and may not be used at all. Any practical shipbuilder will readily understand the pecuniary loss and delay involved in this. A fourth objection, and the most serious, is that the delays and uncertainties involved in testing at the yards, not only tend to but actually do disorganise these establishments. In the case of my own firm, we have lost some of our best workmen through this cause. I understand Lloyd's Committee have it under consideration to remove this very serious difficulty, and I sincerely hope they will do so.

Another difficulty in the way of steel is its supposed greater liability to corrosion than iron. Till now, upon this point, my firm's experience has been small. The *Taeping* paddle-steamer built of Bessemer steel by us in 1876, has been so far reported upon most favourably in regard to the matter of corrosion. On the other hand a small twin-screw built by us of Siemens-Martin steel in 1878, for trading in the creeks of the lower Irrawaddy, has been reported as showing a considerable amount of pitting between the light and load water-lines, but the reports sent home are not sufficiently full to enable the cause of this pitting to be defined. It may be due to the peculiar brackish water in which the steamer was working, as compared with the fresh water in which the *Taeping* runs.

I am strongly inclined to think, however, that this case is purely local and exceptional, and the directors of the Company have adopted this view in deciding to build their latest and largest paddle-steamers of the same material.

The fourth difficulty in the way of steel is the doubt entertained by some as to its reliability and safety in actual service in a ship. This doubt it will, I believe, finally and fully overcome. Our experience, already referred to, of its behaviour under manipulation ought to tell strongly in its favour, and the report on the docking and repairing of our first sea-going steel steamer, the *Rotomahana*, after running on to and over a rock, ought to convince many not only of the reliability but of the actual safety of properly-made steel. Personally I am of opinion that it is a mere matter of time till steel supersedes iron, and its steadily lessening proportionate cost will undoubtedly hasten that time.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

PHILOSOPHICAL SOCIETY OF GLASGOW.

AT a meeting of the Philosophical Society at Glasgow held on Wednesday last week, in the Corporation Galleries—Dr. Fergus in the chair—Dr. James Adams, F.F.P.S.E., read a valuable paper on "Improvements in Gas Stoves."

In the course of his remarks Dr. Adams said—Twenty-five years ago I read to the Glasgow Medical Society a communication on "Heating by Gas," and exhibited a stove made to my design. In my belief that stove surpassed anything since open to public observation. But it was liable to drawbacks, which I then failed in overcoming, and I put aside my conception. I retained, nevertheless, the desire to see it realised, being sensible that I had made a substantial step in advance, and I have informed myself and noted with interest all that has since been done in this connection. About eighteen months ago I re-entered with zest upon a practical investigation, feeling assured that the principles were sound that I had assumed for my guidance, and had partially embodied in my infant conception. I will now bring under your consideration a practical illustration of those principles. Coal-gas is not of uniform composition. It is a mixture of gases and of vapours, the numbers, qualities and proportions of which vary in every locality where coal-gas is manufactured for public use. Its most abundant constituents are compounds of carbon and hydrogen, the latter forming the bulk of the mixture. However carefully manufactured, impurities are always present, which, together with the gaseous waste products of combustion, should never be permitted to accumulate in the air of dwelling apartments. When coal gas is burned its constituents are transformed into other gases and vapours. On this point there is much pupular ignorance. Because no smoke and little or no odour may be perceptible it is assumed that the combustion has left behind it nothing injurious. There is a hazy conception that perfect combustion means something like practical annihilation. But, in point of fact, the invisible, mal-odorous, inflammable gas has been merely transformed into invisible, non-odorous non-inflammable gas. The carbon has united with oxygen of the air and formed carbonic acid, a deadly poison if inhaled pure, and the hydrogen has united also with oxygen of the air and formed watery vapour, whilst a large quantity of nitrogen has been see free from the air. But if combustion has not been perfect, there is formed, in addition to carbonic acid, another still more poisonous gas called carbonic oxide. The common-sense deduction is that all gas stoves should be provided with flues to carry off the waste products of combustion into a chimney. The several properties through which heat is communicated, viz., conduction, convection, and radiation, have each their special value and appropriate use, and ought to be carefully considered, so as to best ensure the maximum intensity of each property as well separately as in combination. By accurate observers it has been determined that about three-fourths of the heat of an open fire consists of the heat of convection, nearly all of which passes up the chimney, leaving only a fourth to be utilised as radiant heat. When coal-gas is used as fuel, and the ordinary jets for lighting purposes are employed, the convected heat generated amounts to 84 per cent., or five-sixths of the entire heat, and only 16 per cent., or about one-sixth, is given out as radiant heat. When the Bunsen burner, in any of its forms, is employed, the heat generated is nearly altogether that of convection, only about 6 per cent. consists of radiant heat. This question of the influence of solid particles in a flame was worked out and is recorded by Tyndall in his "Contributions to Molecular Physics in the Domain of Radiant Heat." Using an apparatus of exceedingly sensitive precision, furnished with a dial index that noted the degrees of force—not of heat—he found that the radiation from the luminous gas flame was fully two and a half times that from the non-luminous flame. The degree of force noted in the luminous flame was 30°, and the radiation fell to a force of only 12° the instant the flame became non-luminous. But by introducing solid matter the radiation originating in the hydrogen, or non-luminous flame, became so intense that a spiral platinum wire plunged in the former brought up the index to 200°. That is, there was instantly generated an amount of radiant heat more than six times that of the luminous gas flame, and more than thirty times that of the non-luminous flame. To obtain in a practical form the means of converting the heat of convection into the heat of radiation, and when converted, of practically utilising the same, has been the chief aim of my efforts for the improvement of gas stoves; and my argument is now sufficiently advanced to enable me to refer to the methods I employ, and through which I have obtained my object. I employ in gas-heating stoves a burner consisting of a group of hollow perforated tubes of fireclay, supplied internally with a mixture of gas and air, which passing through the perforations, burns on the outer surface. These fireclay tubes are enclosed in a case or chamber which prevents free access of air to their exterior, where combustion takes place, but by perforations a small quantity of air is admitted, which ascends within and between the tubes and ensures complete combustion. Thus only the smallest practicable excess of unconsumed air is permitted to mix with the products of combustion. The products of combustion are led to a chimney by a flue of peculiar construction, in which they are detained until they have parted with all their available heat; and other channels or ducts lead currents of pure air along the heated walls of the flue channel, and the air, so warmed, is allowed to re-enter the room in which the stove is used. The walls of the air-channels or ducts, and generally the casings of the stove, present an extensive surface to take up the heat from the products of combustion traversing the flue channel, and consequently these surfaces do not become over-heated. The air entering the stove is caused to pass in at or near the top, and thus a supply free from dust is ensured, and draughts along the floor of the apartment are avoided. The warm air issuing from the stove is caused to pass over water contained in a trough so formed that by filling it more or less the surface of water exposed to the warm air may be varied in extent. Lastly—not to dwell on too many points—provision is made by which the risk of explosion is entirely obviated.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting on Tuesday, the 23rd of March, Mr. W. H. Barlow, F.R.S., President, in the chair, the paper read was on "Explosive Agents, applied to Industrial Purposes," by Prof. Abel, C.B., F.R.S., Assoc. Inst. C.E., &c. The author pointed out that, since this subject had been brought by him before the Institution in 1872, the advantages of explosives more violent in character than gunpowder for many important industrial uses had become so widely known and extensively utilised, that the supremacy of gunpowder, as the only practically useful and economical blasting agent, had for some time been a thing of the past. The greatly superior results furnished by dynamite, gun-cotton and other explosive agents of the same class, when applied to work, in which their rending and shattering action was valuable had led to the replacement of powder by them in many directions. It had also had the effect of rendering miners more critical in regard to the quality of blasting powder, a result which had operated beneficially, not only by requiring the bestowal of greater care upon the manufacture of blasting powder, but also by leading to improvements in the nature and form of powder. An improved blasting powder of Messrs. Curtis and Harvey was referred to as one illustration of this. An account was given of the advantages attending the employment of compressed powder, in the form of the charges first devised by Messrs. Davey and Watson, and manufactured by Messrs. John Hall and Son, which were rapidly coming into extensive use, and which presented unquestionable advantages over granular powder, on the score of convenience and comparative safety, as well as of greater efficiency. Other improvements in the application of gunpowder having been referred to, the author proceeded to examine into the progress which had been made in the production and application of preparations of gun-cotton and nitro-glycerine, observing that but few of the many proposed substitutes for gunpowder, to which he had alluded in 1872, had received any important applications.

The advantages attending the employment of wet gun-cotton were described, and the manner in which its detonation was brought about was examined; the theory of the development of detonation, as distinguished from explosion, and of its transmission, being incidentally discussed. Various important technical applications of wet gun-cotton, dynamite, &c., were referred to, as illustrating the utilisation of the comparatively instantaneous character of detonation. It was pointed out that the safety, power, and comparative simplicity attending the application of wet gun-cotton to the larger operations for which violent explosives were valuable, had led to its adoption for submarine mines, torpedoes, and military engineering operations generally. On the other hand, compressed gun-cotton, employed either wet or dry, was now only used to a limited extent as a blasting agent, chiefly in the form of preparations sold under names by which their actual nature was disguised. Thus, a variety of nitrated gun-cotton, converted into compressed charges, similar to the original compressed pure and nitrated gun-cotton, was supplied to the miner under the name of Tonite, and its employment as an efficient blasting agent was gradually extending. An account was given of the rapid progress which had been made in the application of the nitro-glycerine and Kieselguhr mixture, called dynamite, to the exclusion of other plastic nitro-glycerine preparations. The employment of dynamite upon a large scale was illustrated by reference to the stupendous operations connected with the destruction of the reef at Hell Gate, in East River, New York, when a total of 49,915 lb. of dynamite and other nitro-glycerine was exploded in one single operation. The objections to the employment of nitro-glycerine in the pure liquid state were pointed out. Reference was made to the tendency of dynamite to freeze, and the necessity for thawing it before use, as a prolific source of fatal accidents in connection with mines and quarries, owing chiefly to recklessness of the men, and their disregard of caution and instructions. In the course of the paper, the author referred repeatedly, and in strong terms, to the mischievous and frequently disastrous effects of misleading statements with respect to the safety of particular explosive agents, such as the absence of noxious gases in connection with their use, &c., which had, from time to time, been published and circulated in mining districts by the manufacturers and vendors, and which not only engendered false ideas of safety, but also encouraged the natural tendency to disregard precautions.

An account was next given of a new class of nitro glycerine preparations, devised by Nobel, of which the so-called blasting gelatine was the type, and which presented such decided advantages over dynamite in several directions, that they had already, to an important extent, supplanted it on the Continent, and promised to extend the safe and efficient application of nitro-glycerine. In giving an account of the properties of blasting gelatine, and of certain difficulties which had to be overcome in its application, the author described a series of experiments he had made with the view of increasing the relative power, &c., of the more important explosive agents. Reference was also made to useful practical results which attended investigations on the transmission of detonation to considerable distances. The paper concluded with a review of the beneficial results in connection with the manufacture, transport, storage and use of explosive agents, which had attended the judicious application of the measures included in the Explosives Act of 1875; and with these comments, on the one hand, on the necessity for increased activity on the part of local authorities in some directions, in connection with the Act, and, on the other hand, on the danger to the public and to commercial interests, resulting from the persistent refusal of railway authorities to facilitate the legitimate transport of explosives.

The discussion was adjourned till Tuesday, April 6th.

INSTITUTION OF CIVIL ENGINEERS.—On Saturday evening last the annual banquet of this body was held at Willis's Rooms, the chair being occupied by the president, Mr. W. H. Barlow. Mr. W. H. Smith, M.P., responded for the Navy, answering the reproach that the Admiralty were slow to avail themselves of inventions. They were ready and glad to avail themselves of an invention when it is proved to be really useful and successful, but they were not willing to restrict themselves to one type of ship, because they knew from experience that month by month added to the energy and power with which it was possible to arm our ships and make them more formidable in the defence of this country. In reply to "The Houses of Lords and Commons," the Earl of Derby said, speaking in this room and in this distinguished assembly, I cannot help contrasting your work and ours. Politicians cannot but feel some envy of those who have to deal, not with the uncertain caprices and fluctuating passions of men, but with the unchanging laws and forces of nature. Whatever the success of the politician may be, two things are certain; one is, that it is limited in its sphere of operation; and the other is that the effect of his work is temporary, and, in most cases, ephemeral in duration; while in your case every step gained by applying science, every victory of man over nature is gained for all nations and for all time. Therefore, however uncertain the political victories of the world may be, and I mean by that the victory of man in his relations to his fellow men, we have some right to look forward to a steady and continued advance of scientific progress with a confidence which is justified by the past, and which we believe will be realised in the future. Mr. Giles, M.P., responded for the House of Commons. The German Ambassador and Dr. Tyndall responded on behalf of the visitors. Sir G. Jessel asked the guests to drink to the prosperity of the Institution. He dwelt on the necessity of good gas and proper ventilation, especially of that extraordinary combination of foul air and crowded human beings known as a law court. He hoped the Institution would enable the people to get more and purer water. The toast was cordially received, and the proceedings soon afterwards closed.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS.—On Friday, the 19th inst., the Association of Municipal and Sanitary Engineers and Surveyors held a district meeting at Dewsbury, in Yorkshire. The proceedings were commenced by Mr. Graham Smith, C.E., secretary, reading a paper by Mr. E. H. Allies, on the Sewage Disposal of West Derby, near Liverpool. In the paper were given sketches showing that the proceeds from a sewage-farm when properly managed may be made to cover its working expenses. Mr. B. C. Cross, Borough Engineer, Dewsbury, then read a paper dealing with the sewerage scheme now being carried out by that borough. This paper went fully into the subject of the design and construction of the various sewers and works, and other matters relative thereto, such as the population and death-rate of the district. The members then thoroughly inspected the works, and were generally satisfied with the works and the various novelties which have been introduced into their design by Mr. Cross. During the course of the day the members were taken a trip in a tramcar drawn by one of Mr. Merrywather's steam tram engines, and were accompanied by Mr. Gomersall and Mr. Truswell, the manager of the Tramway Company.

THE EDISON TELEPHONE.—Edison telephones have been installed at the Pic du Midi Observatory, and afford easy communication with Bagnères, a distance of 15 miles. The first experiment failed, owing to the cloudy and stormy intervening stratum of air, but with improved instruments every sound pronounced in the ordinary conversational pitch is distinctly audible.

THE ALBERT HALL EXHIBITION.—On Monday, the managers of the Royal Albert Hall opened an Exhibition intended apparently to be made annual, but of which the character must vary from year to year, and this year particular attention happens to have been bestowed upon a branch of art generally little understood—the art of Wood Carving. Learners in the art of wood-carving, and those who will like to be amateurs now that a chance of learning is afforded them, have a distinct treat in store for them at this present Exhibition. It is a long time since so great an array of good and varied work of this description was gathered together.

AGRICULTURAL EDUCATION.—On Wednesday last week a meeting of farmers and others was held in the large room of the Bear Hotel, Cowbridge. Mr. T. Bassett occupied the chair. Mr. Buckmaster referred to the efforts being made to promote the technical or professional education of persons engaged in manufactures; it was most important that this education should now be extended to those engaged in agriculture. There was no industry which depended on such varied scientific knowledge as the cultivation of the earth, which was the mother of every industrial art, and no country could long continue prosperous where the agricultural industry was in a declining condition. A resolution for establishing a class for teaching the principles of agriculture in connection with the Science and Art Department was unanimously adopted.

IRWIN'S STEAM INJECTOR AND EJECTOR.—The report of a committee of the Franklin Institute, which recently spent five days in examining the action of Irwin's steam injector and ejector, appears in the journal for February. They consider Mr. Irwin has contributed a valuable improvement in injectors, increasing their power of augmentation to above twice that of the pressure of steam used for practical working without waste, and about four times with waste at the overflow. It seems to be a general law that the lower the steam employed, the higher could the proportional augmentation of pressure be carried. Among the peculiarities of Irwin's apparatus is that of the water-supply pipe and overflow being set at an angle of 45° to the axis of the instrument; also the permitting of free entrance of atmospheric air at and through the overflow; both of them, it is claimed, increasing materially the power of augmentation.

THE TOPOPHONE.—A new instrument, called by this name, has been experimented upon and described by Professor Morton in his report to the Lighthouse Board of the United States, by which the exact direction of sound given by fog-horns or fog-bells may be ascertained. The machinery is very simple, and consists of a vertical rod passing through the roof of the deck cabin, to the upper end of which are attached two adjustable resonators. Below these is a pointer, set at right angles to the bar, while rubber tubes pass through the cabin roof and are connected with a pair of ear tubes. The whole apparatus can be turned towards any direction, and the result is that any person sitting in the cabin, by turning round until the least sound was perceptible, would bring the pointer to within ten degrees, or less than one point, of the direction. The experiments proved that it was easy to ascertain whence the sound came from a distance of four to six miles.

INSTRUCTION IN GREEK ART.—The *Athenæum* says that a movement has been set on foot by the classical professors at King's and University Colleges, in conjunction with the Committee of the King's College Lectures to Ladies, to provide for instruction in Greek art, to utilise the collections of the British Museum with that object. Mr. C. T. Newton, C.B., has undertaken to deliver the first course, consisting of eight lectures on Greek Sculpture and Painting, at the Botanical Theatre, University College, during the months of May and June next, commencing May 5. The lectures will be accompanied by visits to the British Museum, and will have special reference to the works of art which can be studied there. The co-operation of the principal colleges and schools in and near London will be invited, and if the present movement is well supported it is hoped that much may be done thereby to facilitate the systematic study of Greek art as a branch of classical education, which has recently been so strongly advocated in several quarters.

THE INSTITUTE FOR THE ADVANCEMENT OF TECHNICAL EDUCATION.—At the meeting of the Common Council on Thursday, last week, Alderman Sir B. Phillips presiding, a letter was read from Lord Selborne, the Chairman, and the Council of "The City and Guilds Institute for the Advancement of Technical Education," submitting that the time had now arrived for some definite resolution to be come to by the Corporation of London as to the support they might feel disposed to give to the Institute, and stating that an arrangement had been concluded with the Commissioners of the Exhibition of 1851, which the Council hoped and believed would remove all uncertainty and difficulty as to the establishment of a Central Institute. The Council asked the co-operation of the Corporation in their scheme. Mr. Beck, a member, had given notice of his intention to move that it be referred to the Finance Committee to consider what amount the Corporation should give to the Institute; but the matter was postponed, in order that the scheme might be printed and circulated among the Common Council.

MEETINGS FOR THE WEEK.

MONDAY, MARCH 29.

GEOLOGISTS' ASSOCIATION.—Two days' excursion to the Coast of Hampshire, under the direction of Mr. J. S. Gardner, F.G.S.

TUESDAY, MARCH 30.

CHEMICAL SOCIETY.—8 p.m. Anniversary.

THURSDAY, APRIL 1.

ROYAL ARCHÆOLOGICAL INSTITUTE.—4 p.m.

SOUTH KENSINGTON MUSEUM.—8 p.m. Dr. W. Stone, on Sound in Relation to Music and Musical Instruments.

CHEMICAL SOCIETY.—8 p.m. 1. Dr. Stenhouse and Mr. C. C. Groves, β Arcinol. 2. Mr. R. W. Atkinson, on the Action of the New Diastase, Eurotin, on Starch. 3. Mr. Lewis T. Wright, on the Products of Combustion of Coal Gas. 4. Mr. H. Chapman Jones, on Polysulphide of Sodium. 5. Mr. Thomas Bayley, on the Reflection from Copper and on the Calorimetric Estimation of Copper. 6. Messrs. Watson Smith and Davies, on Pyrene. 7. Mr. Watson Smith, Analysis of the Ash of two varieties of Eucalyptus.

LINNEAN SOCIETY.—8 p.m.

FRIDAY, APRIL 2.

SOUTH KENSINGTON MUSEUM.—8 p.m. Dr. Stone, on Sound in Relation to Music and Musical Instruments.

SOCIETY OF ARTS.—8 p.m. Indian Section. Mr. B. Haughton, on the Best Route for a Line of Railway to India.

GEOLOGISTS' ASSOCIATION.—8 p.m. Professor H. G. Seeley, on the Psammolithic Formations between the Kimmeridge Clay and the Gault.

METALLURGY AND MINING.

RICH COPPER LODE.—A Melbourne paper states that arrangments are being made there to work a copper mine near Dotswood, Queensland, where an extensive and rich lode of copper is known to exist. The ore is described as being of the richest kind known, viz., virgin copper and red oxide, and specimens examined have yielded 58·2 per cent. of copper and 5 dwt. of gold and 4 oz. of silver per ton of ore.

GAS IN METALLURGY.—The report of the uses of gas from natural springs, in some American puddling furnaces, is attracting the attention of European metallurgists. At the *fontaine ardente* of Saint-Barthélemy, in France, there is a natural gas-well which has been allowed to run to waste for centuries. Preparations have been lately made to make some economical use of this apparently inexhaustible supply, and some sanguine hopes have been expressed that it may convert the province of Dauphiné into a French Pennsylvania.

WIDE DIFFUSION OF COPPER.—Dieulafait has published a memoir upon the existence of copper, in a state of complete diffusion, in all the rocks of primordial formation and in all the sedimentary deposits which are directly derived from the primordial. As principal consequences of this fact he points out: (1) The constant existence of copper in the sea waters of ancient and modern times. (2) The origin and mode of formation of copper ores. (3) The necessary presence of copper in all the mineral waters of azoic regions.

AN ANCIENT PIECE OF IRON.—A small piece of iron was found under the Egyptian obelisk which is to be removed to the city of New York, and it has been handed to Mr. A. L. Holley for examination and report upon its quality. Mr. Holley has given to the New York *World* a communication on the subject, from which we take the following particulars:—"The specimen was too small far any physical test whatever. A clean fracture revealed to the expert eye a rather highly carburised and granular but tough-looking metal, not unlike what is called puddled steel. I sent the specimen to Dr. Wendel, the able chemist of the Albany and Rensselaer Iron and Steel Works, who took such an interest in the matter that he made the following very complete analysis:—Iron, 98·738; carbon, 0·521; sulphur, 0·009; silicon, 0·017; phosphorus, 0·048; manganese, 0·116; nickel and cabolt, 0·079; copper, 0·102; calcium, 0·218; magnesium, 0·028; aluminium, 0·070; slag, 0·150; total 100·096. If we had not known from the general history of the iron manufacture that the specimen must have been made by the Catalan proces, the analysis would have so indicated. The notable facts are: About one-half of one per cent. of carbon, giving the hardness of ordinary rail steel; very low silicon and phosphorus, due to the method of manufacture, and a remarkably large amount of calcium, indicating the plentiful use of lime as a flux in the process. The small amount of slag (for a Catalan product), as well as the fine fracture, indicates frequent reworking.

RAILWAYS & TRAMWAYS.

OPENING OF A NEW RAILWAY VIADUCT.—During the week a source of anxiety to some travellers by rail has been removed by the opening of the new viaduct on the Lancashire and Yorkshire line between Huddersfield and Penistone. The line, which crosses a deep valley at Denby Vale, was, at the time of the construction of the railway, passed over by a wooden viaduct, presenting anything but a pleasant and safe appearance, so much so that it is said some travellers avoided it by taking it a different route. The danger—if it ever really existed—is now set aside by the opening of a splendid substantial new viaduct erected by Messrs. Naylor Brothers, the contractors, which has recently been passed by Major Marinden, one of the Government inspectors, who viewed the erection in company with Mr. Hunt, the engineer of the Lancashire and Yorkshire Railway, and other officials.

GOVERNMENT RAILWAY SUPERVISION IN THE UNITED STATES.—A rigid system of railroad supervision (says the Chicago *Railway Review*) is being instituted in Georgia. The State now virtually manages the railroads. The railroad commission of that State this week adopted rules governing and regulating all traffic rates within the State. By these rules freight tariffs are sweepingly reduced, and discrimination of any character whatsoever is strictly prohibited. Passenger fares are placed at four cents per mile with ticket, and four and a half cents without, and the maximum sleeping car fare is fixed at one cent per mile. The commission (adds the *Review*) seems disposed to exert the extraordinary powers conferred upon them by the State to the fullest extent; but the inevitable reaction will demonstrate to the people of Georgia, as it has done in several Northern States, that protection of the public does not require oppression of the railroads. Furthermore, the fact will be made patent that an assault on the railroad interest eventually operates as an assault upon the public interest, so closely are they allied.

A NEW WAY OF HEATING RAILWAY CARRIAGES.—It is reported from Lyons that the Compagnie Paris-Lyon-Méditerranée is now trying a new method of heating in express trains. The method was proposed by M. Ancelin, an engineer, and consists simply in the use of acetate of soda in the foot-warmers. The substance has considerable latent heat; dissolving at a certain temperature, it thus absorbs a large quantity of heat, which becomes sensible during crystallisation in cooling. All that is required is to fill the ordinary cases with a sufficient quantity of the acetate, close them, and place them in a stove at about 100°. The cooling of a case thus charged and heated takes twelve to fifteen hours. The warmers are thereafter taken from the compartments and placed in a stove (where the crystals of soda acetate are redissolved); they are then ready for fresh use. The advantages of such a system are obvious—no necessity of changing warmers every two or three hours, or of maintaining a numerous body of men at stations to attend to them; economy in cost of heating, &c. Moreover, most of the existing foot-warmers can be utilised. Acetate of soda is not very expensive, and it could easily be manufactured in much larger quantities than at present if the demand required it. The new system has been tried on the express train, No. 5, leaving Paris at 7·15, and reaching Perrache at 4·31. The compartments were each supplied at starting with two warmers containing acetate of soda. At Perrache most of the warmers were still so hot that one could not apply the back of the hand to them. From Lyons to Marseilles the train was heated on the ordinary system.

NAVAL ARCHITECTURE.

H.M.S. "NELSON."

LIKE the *Northampton*, the *Nelson* is an improved *Shannon* and is desgned to cruise either under steam or sail, or both combined. She measures 280 feet in length, and 60 feet in beam, and has a displacement of 7323 tons. Only the central part of the ship, which is 180 feet of the whole length, is armoured, the protection extending from 5 feet below the water-line to the shot-proof main deck (which is 4 feet above the water), and tapering from 9 inches to 7 inches in thickness. An important peculiarity in the ships of this type is that the steering gear and tillers are well under water and the armour deck, thereby securing an efficient protection to what is in most men-of-war a vital part most dangerously exposed.

The machinery of the *Nelson* consists of a pair of compound vertical engines, designed by Mr. A. C. Kirk, and manufactured by Messrs. Elder and Co., of Glasgow, by whom also the ship was constructed. Each engine has two cylinders, a high-pressure cylinder 60 inches in diameter, and a low-pressure cylinder having a diameter of 104 inches, with a 3 feet 6 inches stroke. Instead of being driven by a rocking beam off the piston-rod head, as is usually the case, the air-pumps are worked by an eccentric on the main shaft, which also drives the feed-pumps. The peculiar design of the engines originated in a request from the Admiralty to the contractors for the machinery of the *Nelson* and the *Northampton* to forward alternative plans for an engine in which the framing, with a view to save weight, might be incorporated with the structure of the ship itself. While, therefore, Messrs. Penn and Son, in the *Northampton*, introduced an arrangement for converting the compound engine into an ordinary one at full power, by working the steam direct from the boilers into the whole of the three cylinders, in the *Nelson* the compound principle, as being, in the opinion of the manufacturers, the lightest and most economical, is strictly adhered to. The total weight of the machinery, including the water in the boilers, is 998 tons, and the power indicated on the six hours' trial at Plymouth amounted to 6246 horses, realised with the ship at her natural draught and without the use of the blast, which is almost equal to 3·2 per cent. per indicated horse-power additional. The speed of the ship on the occasion was 14·477 knots, and the coal consumption 2·14 lb. per unit of horse-power developed. To carry out the extreme lightness of the design without any sacrifice of strength, the engine framing was made entirely of wrought iron, the body of the condenser of thin rolled brass, and the upper part of wrought iron galvanised, while the air-pumps were cast of brass. The framing consists of four wrought-iron columns to each cylinder, united at the bottom by wrought iron forged plummer blocks, bolted to the frame of the ship, while the diagonal strains are taken by round diagonal stays which connect the cylinders of the starboard engine to the sole plate of the port engine and *vice versâ*. These diagonal stays cross in the fore-and-aft bulkhead between the engines, and pass through it by a watertight joint. In order to minimise friction, the steam is admitted to the cylinders by cylindrical piston valves, one to the high-pressure cylinder, and two to the low-pressure cylinder, while the gear for working them consists of a link motion, which is reversed by a direct-acting steam cylinder, controlled by a cataract oil cylinder. This link motion is the only questionable part of the design—which is of a truly heroic character—seeing that it has a much greater number of joints and moving parts than is usual, and in consequence of the comparative shortness of the rods, throws a large amount of strain upon the link block. It worked well, however, at the trial, and gave no trouble. The screw propeller is of the Mangin type, as it was thought it would offer less resistance when the ship was under sail than the ordinary four-bladed Griffith. It has a diameter of 17 feet 10 inches, and a mean pitch of 19 feet 6¾ inches. In general arrangement the engines and boilers follow the most recent navy plans—two pairs of engines, one driving the port and the other the starboard propeller, with the boilers, which are ten in number and of the ordinary high-pressure type, placed back to back, the firing being performed athwartship from the wings. The machinery space is subdivided into six separate watertight compartments. There is a midship fore-and-aft bulkhead dividing the engine-room into two, and the boiler space into four, as it is further crossed in the middle of its length by a transverse bulkhead. The ship is provided with the usual complement of fire engines, donkey engines, steering engine, and ash-hoisting engines, and a complete arrangement of stop-valves is fitted which enables them to be worked from the deck. In the event of any of the six machine compartments being flooded with water, not only can the steam be cut off from the particular compartment, but it can be taken past it without the pipes being exposed to the action of the cold water, which would otherwise condense the steam. The machinery of the *Nelson* cost, according to the Navy Estimates for last year, £83,530.

For the purpose of the trials above referred to, the *Nelson* was brought down to her normal load-line of 24 feet forward and 25 feet aft by 350 tons of water ballast, of which all but 50 tons were put in at Sheerness; and she had on board besides about 60 tons of trial coal, in addition to 546 tons of ordinary coal. The ship left the dockyard at half-past twelve for the Solent, and the trial was proceeded with continuously until 6 o'clock, when it terminated, the circle steaming being postponed for the present. The sea was what is technically described as "smooth," but a lively breeze blew all the time with a force of 4 from the south-west, and consequently directly abeam throughout the runs. A very short canter beyond the Warner sufficed to put the furnaces into proper trim, and to cause the safety-valves to blow off under a pressure of 64 lb. Indeed, an abundant supply of steam was generated all through the trial without any necessity arising for the use of the blast. The full-power runs were the first completed, the four being made with the tide as near dead water as could be. The following were the results:—

Runs.	Time. M.	Time. S.	Revolutions. Starboard.	Revolutions. Port.	Knots.
1	4	28	81·71	81·94	13·433
2	4	9	81·68	83·85	14·458
3	4	20	81·46	82·38	13·846
4	4	16	80.85	82·96	14·062
	Means		81·42	82·78	14·050

The mean revolutions of both engines were 82·10, the other means being—pressure in boiler, 64·5 lb.; vacuum, 26 inches starboard, and 26·37 port; pressure in cylinders; starboard engine, 32·75 and 11·90 lb.; port engine, 32·525 and 11·15 lb. The indicated horse-power was 6624·57, 6000 horses was the contract power, and the excess was readily obtained without any water being necessary to keep the bearings cool. The throttle valves having been adjusted, four runs were next made at two-thirds power, with the following results:—Steam in boilers, 58·75 lb.; vacuum, 27·12 inches and 26·50 inches; revolutions, 71; indicated horse-power, 4,125·87; and speed of ship, 12·856 knots per hour. The last progressive trial was made at one-third power, the means being as follows:—Boiler pressure, 59·87 lb.; vacuum, 27 inches and 26½ inches; revolutions, 58; indicated horse-power, 2323·47; and speed, 10·537 knots. There being abundance of time at the termination of the series of progressive trials, it was determined, at the request of Mr. Wright, to make a full-speed trial of the ship with only one of the engines going, the other being for the moment supposed to have been disabled. With the starboard engine at rest a mean speed of 10·600 knots was realised, with 75·64 revolutions, and 2995·3 horse-power; and with the port engine stopped the result gave 72·25 revolutions, 2904·06 horses, and a speed of 10·101; from 15 degrees to 17 degrees of helm being required to keep the ship in a straight line. Two diagrams were subsequently taken while the vessel was creeping at her lowest possible speed to the anchorage, for the purpose of enabling Mr. Wright to calculate the power required to overcome the dead friction of the machinery. The trial was in every respect satisfactory.

LAUNCHES.

ENGLISH.

Skyro.—On the 13th March there was launched from the shipbuilding yard of Mr. James Laing, Deptford, an iron screw-steamer of the following dimensions, viz.:—Length (extreme), 235 feet; breadth, 32 feet; depth, 16 feet; and having a carrying capacity of 1530 tons. Engines of 115 horse-power, by Mr. George Clark, of Southwick. The steamer is fitted with patent windlass, three steam winches, patent topsails, large hatchways, water ballast, &c., and is especially adapted for the Baltic and ore trade. As she left the ways she was christened the *Skyro*.

TRIAL TRIPS.

Copenhagen.—The paddle-steamer *Copenhagen*, built and engined by Messrs. Lobnitz, Coulborn and Co., in 1867, for the mail service between Copenhagen and Aarhuus, having been found by her owners too small for their rapidly-increasing traffic, has been lately returned to the builders for lengthening by 33 feet, and to receive new boilers and increased passenger accommodation. On Saturday last she went her trial trip between the Cloch and Cumbrae lights, and easily attained a speed of sixteen miles on two consecutive runs. The passenger accommodation is of the most sumptuous description for 150 first-class passengers, and the vessel is fitted with Messrs. Muir and Caldwell's steam steering gear, fitted throughout all saloons and state-rooms with steam heating apparatus, also electric bells are being fitted, and the British Electric Light Company are fitting on board their improved system of electric lights throughout all the cabins. This vessel is the property of the United Steamship Company, of Copenhagen, managed by Consul C. P. A. Koch.

Toledo.—This vessel, which was lately launched from the building yard of Messrs. Barclay, Curle and Co., for the Leith, Hull and Hamburg Steam Packet Company, proceeded to Skelmorlie on Saturday last for the purpose of running her speed trials at the measured mile. The trials were made upon the progression system, and being commenced at a speed of four knots gradually attained the maximum speed of 9½ knots, which was considered highly satisfactory. This vessel has been specially designed for the Baltic grain-carrying trade, and is intended to carry a large dead-weight cargo on a light draft of water. She is fitted with shifting boards in lower hold and 'tween decks of a most substantial character, and has all the most modern improvements for loading and discharging cargo. As has already been stated, this is the first vessel belonging to the Leith, Hull and Hamburg trade built entirely of steel. The dimensions are 250 feet keel and forerake, 33 feet beam, and 17 feet 3 inches depth of hold. She is fitted with a tank hold capable of holding 330 tons of water-ballast, which is filled and emptied by means of an injector in the short space of two hours. A novel feature in the lamps has been introduced by the introduction of a patent burner supplied by the Oakbank Oil Company to burn heavy mineral oil, which gives a fine clear light, and at the same time is a source of great economy. Those for the officers' and engineers' cabins are fitted with Hinck's patent extinguisher—a great improvement on the ordinary ships' lamps.

Villarino.—The new screw-steamer the *Villarino*, just completed by Messrs. Laird Brothers for the Argentine Government, and intended to be employed as a transport and storeship, made her official trial trip at the mouth of the Mersey on Tuesday last week, and the results obtained were highly satisfactory to all concerned, the vessel attaining a speed of nearly 12 knots, or fully a knot beyond that stipulated by the contract. The *Villarino* is an iron vessel, 180 feet long, 30 feet beam, and 14 feet deep in hold, fitted with engines of 800 indicated horse-power. She is now completing for sea in the Birkenhead Dock.

REGISTRATION OF SHIPS.—The Board of Trade has issued a list of ships reported during the month of February, 1880, to the Registrar-General of Shipping and Seamen as coming into Registry; as also of ships the registers of which were closed. We find from this return that 84 vessels were registered, of 25,742 gross tonnage, of which number 16 were purchased from foreigners, and that 163 were removed from Registry; of these latter 30 were sold to foreigners, 34 were wrecked, 10 stranded, 16 lost, 32 broken up, 14 abandoned, 3 were in collision, 5 missing, 13 foundered, 2 were burnt, 9 condemned, and 5 struck off for other causes.

THE NEWHAVEN HARBOUR COMPANY.—In the arbitration between the Earl of Sheffield and the Newhaven Harbour Company, held before Mr. John Clutton, as sole arbitrator, at the Surveyors' Institute, Great George Street, Westminster, Mr. Clutton has, we are informed, now made his award, the amount of which is £17,500. It will be remembered that the arbitration had reference to the amount of purchase-money and compensation to be paid by the Harbour Company to Lord Sheffield in respect of a large tract of mud-land and foreshore called the Salts, on the eastern side of the river Ouse, at Newhaven Harbour, and a considerable strip of land along the western bank of the river, with some warehouses and buildings thereon, which are required by the Harbour Company for the purposes of their tramway and wharf and other works now in course of construction.

RAISING SUNKEN VESSELS.—An operation which excited some interest took place in the Itchen river, at Southampton, a few mornings since, successfully resulting in the raising of the wreck of the steamship, *Tyne*, which had sunk nearly opposite the Gasworks. This vessel formerly belonged to the Royal Mail Steam Packet Company, but had been sold out of their fleet and was in progress of demolition, when, a storm arising, she filled with water and sank, her back being partly broken as she was thrown on the shoal, where she rested when the operations began. The ship being partly uncovered at low water, an 8-inch steel wire hawser was connected to the stem and stern, and passed over a timber framing in the centre of the ship, and the ends of the hawser being drawn upon and tightened prevented any fear of the vessel breaking in two when she rose off the bank. The chief difficulty, however, was to empty the vessel of water in the short time that elapsed between extreme low tide and the period when the ship was entirely covered, as, the decks having been removed, there was nothing to fix any machinery to, and anything left on board during high water must be exposed to the action of the sea water and tide, which runs very quickly at the spot, until low water, thus rendering the use of ordinary pumps almost impossible, or at any rate very troublesome. Application was made to the Pulsometer Engineering Company, of London, who agreed to undertake the pumping. Four of their No. 9 pulsometers, capable of throwing several tons of water per minute, were suspended by chain blocks to the wire rope above mentioned, and iron steam-pipes carried to the side of the vessel, where they were connected by flexible hose to the boiler of the tug, *Sovereign*, retained to supply steam for driving the pumps. Everything being in readiness, pumping was commenced between four and five o'clock on the morning in question, and all the water was discharged overboard in a very short time. On the return of the tide the wreck rose with it, and by the aid of three steam-tugs was safely conveyed across the river into the graving dock. By the use of pulsometers all the difficulty of fixing was removed, as these pumps work just as well when suspended as fixed, and are not injured by being immersed in the water.

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TO READERS AND CORRESPONDENTS.

ERRATUM.—FORM OF RIVETED JOINTS.—In this article, page 203, line 16, read "In some experiments made by Mr. Kirkaldy for the West Cumberland Steelworks, iron rivets in steel plates sheared at 15 to 19 tons."

NOTICES OF BOOKS.

Sewage Disposal. By HENRY ROBINSON, M.I.C.E., &c. London: E. and F. N. Spon. 1880.

SEWAGE DISPOSAL is the opprobrium of engineering science, which seems incapable of suggesting any effective means not merely of utilising the refuse of our towns, but even of taking it clear of them. The book before us is only a small octavo of eighty pages, but the author has contrived to compress a great amount of useful fact into it. His data have been collected in the course of professional duty in advising sanitary authorities as to the best mode of sewering towns and disposing of the sewage, and he confines himself to the refuse conveyed away by the water-carriage system, which is the most troublesome. In this system the prompt removal of the sewage is of the utmost importance, and the author recommends as the best practice that sewers should be designed to deliver one half the total daily flow in six hours. The chapter headed memoranda for sewage contains a great deal of information in fact and figure. The application of sewage to land on a large scale is probably the least productive way of disposing of it, but in some cases such application, especially to grass lands, has proved remunerative. There is, however, no small danger incurred by those living in the vicinity of sewage farms. The chemical treatment of sewage enables a great part of the impurities to be removed and an effluent water of considerable purity to be introduced into rivers, which can be further purified by encouraging the growth of water weeds in the streams. Some of these plants are very powerful assimilators of river impurities. Mr. Robinson gives a full account of the most noted chemical processes for the treatment of sewage, adding a comparison of them in tabular form.

Winding and Overwinding. By C. M. Percy. Wigan: *Observer* Office. 1880.

This is the second edition of a lecture on a very important subject, delivered in the beginning of the year at Wigan, in the Mining and Mechanical School, in which Mr. Percy is lecturer on Mechanical Engineering. The terrible accidents that occasionally occur from overwinding have created a general feeling in favour of the application of some mechanical contrivance which shall, if possible, prevent them, and the mine inspectors have recommended detaching hooks, in which the author agrees, with the addition of catches to prevent accidents with a descending cage. He then proceeds to give the requirements of a good detaching hook, and to describe some of those chiefly in use.

The Audiphone. By Richard S. Rhodes, Chicago, Illinois. Chicago: Rhodes and M'Clure.

This is the description of a remarkable apparatus, the invention of Mr. R. S. Rhodes, by means of which even deaf mutes are enabled to hear, the sounds being conveyed to the auditory nerve of the person using it through the medium of the teeth. An arrangement of the instrument enables those born deaf and dumb to hear the sound of their own voices. The construction of the audiphone is very simple; the circumstances which led to its invention were the following. Mr. Rhodes, who has been deaf for twenty years, had tried every form of ear trumpet without benefit. He had fallen into the habit of placing his watch between his teeth and listening to its ticking, and one day it suddenly occurred to him that he could hear articulate language in the same manner. He then began experiments to find a proper medium for conducting sounds to the ear through the teeth, and after two years perfected the audiphone.

Patent Law and Practice. By A. V. Newton. Enlarged Edition. London: Trübner and Co. 1879.

This work is offered, not as a complete exposition of patent law, which is intricate and difficult, but as a convenient handbook, to give the inventor a general knowledge of proceedings in relation to patents—in the words of the author, "to put the person seeking a patent in such a position that he shall not have to trust ignorantly to those to whom he may be led to confide his business, and to enable him to appreciate at its just value the advice that may be offered him." The nature and operation of patents and the laws relating to them are explained; patentable and non-patentable inventions are defined and discriminated; the proceedings requisite to secure or oppose a patent detailed; and a chapter follows on patent-agents. The rules of the Commissioners and schedules of stamp-duties and fees are given in an appendix. The distinguishing features of the present edition consist in modifications to meet changes in legislation, the chapter on patentable and non-patentable inventions, with some minor improvements.

Wörterbuch der Marine. By P. E. Dabovich. Pola, 1880. Part III.—We have had occasion to call attention to the previous parts of this work, as furnishing an excellent example of the superiority of a specialised dictionary of science, arranged on a phraseological principle, over the ordinary technological dictionary. The present part shows the same amplitude of conception and accuracy of execution which characterises its predecessors. The typographical execution is surprisingly accurate; it is no easy task to escape literal errors in a work where a phrase of English succeeds to a phrase of French, German and Italian, crossed by references to scientific Latin, but these have been escaped, so far as we can say, very dexterously. English technical idioms are not very easy things to handle, but here again we have to compliment the compiler on his success. For "the coal requires a large draught" (p. 216), we think we should have preferred a "strong" draught, and "skipper" might have been cited as a frequent alternative for "captain." Minute criticism of this kind we might perhaps multiply if we wished to prove that English is nowhere understood better than in England. But we have no desire to do otherwise than compliment the painstaking author on the success of his work as a whole.

A Guide to Modelling in Clay and Wax, &c. By Morton Edwards, Professor of Modelling. London: Lechertier, Barbe and Co. 1879.

The author of this little work has been engaged in the profession of sculpture for over thirty years, during the greater part of which he has taught the art of modelling. He is thus in every way fitted for initiating the artistic neophyte, and his instructions, while thoroughly practical, include the smallest minutiæ of the delicate operations necessary for moulding a figure in the plastic materials employed by sculptors in constructing the models from which they work. The opening chapters contain a brief history of sculpture and work in plastic clay; and in succeeding ones the whole process is minutely laid down, and the apparatus and tools employed are figured and described. The method of modelling in terra cotta and wax is also recounted, with the operation of baking or firing the former. Next follow instructions how to carve in marble and alabaster, to mould and cast in plaster of Paris and to chase and emboss in gold and silver; and in an appendix is given a price list of material and appliances.

NEW BOOKS.

Ambulance Lectures. By L. A. Weatherley. 12mo. Griffith and Farran.
China Colours, and How to Use Them. By E. C. Hancock. Reeves.
Elements of Modern Chemistry. By Adolphe Wurtz. 8vo. Sonnenschein.
Elementary Textbook of Botany. By Dr. Prantl. 8vo. Sonnenschein.
Handbook of Railway Stations. By H. Oliver and J. Airey. New edition. Crown 4to. Oliver and Airey.
Imperial England. By Montagu Burrows. 8vo. Cassell.
Our Scientific Frontier. By. W. P. Andrews. 8vo. W. H. Allen and Co.
Social Notes. Vol. 4. Royal 8vo. Office.
Spons' Engineers' and Contractors' Illustrated Book of Prices. 1880-81. 4to. Spon.
Treatise (A) on Printing. By John Burnet. New edition. 4to. Sotheran.

BOOKS RECEIVED.

An Essay on Colliery Explosions and Safety Lamps. By W. Purdy. London: *Colliery Guardian* Office.
The Export Merchant Shippers, with their Trading Ports and Class of Goods they Ship. 1880. London: Dean and Co.
The Geological Record for 1877. London: Taylor and Francis.

OBITUARY.

Mr. J. C. Dodgson Charlesworth, Chapelthorpe Hall, Wakefield, and Grinton Lodge, Richmond, died at an early hour on Sunday morning after a lingering illness. Mr. Charlesworth, who was the senior partner of the well-known firm of colliery proprietors, was a deputy-lieutenant for the West Riding.

The University of Königsberg lost towards the close of last month one of the oldest members of its professorial staff, in the person of Dr. Ludwig Moser, Professor of Physics. Long before photography had become a practical art, Dr. Moser had acquired considerable reputation by his systematic and successful experiments in this department. He was in his seventy-fifth year.

The late Colonel Eugène Froté, who died recently at Berne, in his 51st year, was an architect and engineer of considerable eminence, and one of the most distinguished officers of the Swiss Federal Army, in which he commanded a brigade. He planned the Jena-Berne-Lucerne Railway, and superintended its execution, the Dachsfelden-Delsberg line, and many others, which, owing to the configuration of the country, presented great difficulties, but all of which by his energy and skill he was enabled to overcome. His death at so comparatively early an age is greatly regretted.

We have to record the death, in his 77th year, of the Marquis P. Selvatico Estense, long known as the director of the Academy at Venice, and writer on art. He had enjoyed the advantage of practical training under M. Demin, one of the best of teachers. His books were numerous, and comprised works on Mantegna, Giotto, Raphael, and others. Among these the most important is "Sulla Architettura, e Sulla Scultura in Venezia," 1847. His work on the history of architecture, of which much has been said, remains incomplete in MS.

FACTORY NOTES.

Mr. J. J. Bodmer has removed his offices from 8, Blomfield Street, to Dashwood House, New Broad Street, E.C.

We understand that Mr. D. M. Yeomans, late manager of the Vacuum Brake Company, has accepted an engagement with the Westinghouse Brake Company, which will, for the future, have the advantage of Mr. Yeomans' experience in railway brake matters.

Steel-faced Armour Plates.—It is announced in the annual report of Messrs. Charles Cammell and Co., Sheffield, that the Government have approved and adopted their compound steel-faced armour plates, which, it is expected, will be largely used in war ships.

Progress in the North West.—The Ellen Rolling Mills Company, at Maryport, owned by Messrs. Kirk Bros., have been put in work this week. The Whitehaven Hematite Iron Company have completed the construction of one of three furnaces being built by them at Cleator Moor.

Direct Spanish Telegraph Company.—The report of the directors for the half-year ending 21st December last, shows a balance to the credit of profit and loss of £4450 2s. 5d. The traffic receipts for the half-year are £1487 13s. 3d. in excess of those for the preceding half-year, and £1664 5s. 11d. in excess of those for the corresponding period of 1878.

South Kensington Museum.—Visitors during the week ending 20th March:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 10,631. Mercantile Marine, Building Materials, and other Collections, 1624. On Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 5 p.m., Museum, 2222; Mercantile Marine, Building Materials, and other Collections, 71. Total, 14,548. Average of corresponding week in former years, 15,674. Total from the opening of the Museum, 18,774,857.

Bolckow, Vaughan and Co. (Limited.)—The ordinary general meeting of the shareholders of the above company was held on Friday, at Manchester, Mr. C. F. H. Bolckow occupying the chair. The report of the directors was adopted, and a dividend at the rate of 5 per cent. per annum declared on the ordinary shares of the company. Afterwards an extraordinary general meeting was held, when resolutions were passed for reducing the shares of the company to a smaller denomination, each fully-paid £100 A share being sub-divided into five fully-paid shares of £20 each, each share with £60 paid up into five shares with £12 per share paid up, and £8 unpaid and each £30 share into two shares, one of £20 and the other of £10 fully paid.

Important Sale of Iron Building Materials.—On the last day of the present month, and the first two of April, there is to be a very large sale of building materials, which belonged to the late Duke of Portland. The iron portion consists of upwards of 150 tons of bar, T and angle iron, as well as girders and moulded iron and bars, supplied by Messrs. Potts, of London, at an expense of several thousands of pounds, for a handsome dome conservatory, the parts of which, we believe, are all included in the sale, the conservatory having been fitted up regardless of expense, but pulled down because it did not exactly please the Duke's eye. There is also a quantity of iron piping, and fittings of a very varied description. Full particulars are to be found in our advertising columns. There will be a further sale of valuable machinery rails, and timber from the late Duke's property in the course of a few weeks.

Manchester Steam Users' Association.—From the report of this Society for 1879, we learn that, notwithstanding the considerable commercial depression, the last year has nevertheless been one of steady progress with this Association. There was an increase in the membership on the 31st December, 1879, as compared with the corresponding period of 1878, of 70 firms, 146 works, and 294 boilers, the number of members, and the number of boilers under inspection, at the close of 1879, was larger than at any previous period. The revenue of the year has also exceeded that of any previous year. During the year 141 firms, representing 412 cylinders, had their engines periodically indicated and examined. The number of boiler explosions in 1879, of which the Committee had information, was 25, by which 40 persons were killed and 52 others injured. Of these explosions two were caused by overheating from shortness of water, and one of these cases took place with a boiler guaranteed by the Association. It was due to oversight of the attendant, who allowed the water supply to run short. The boiler was not moved from its seat, and no person was either killed or injured. In these cases where inquests were held, the juries recommended the enforcement of competent periodical inspection by law; and in a fourth the coroner expressed regret that such inspection was not already enforced.

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—The reports which continue to be received respecting the coal trade throughout this district are of a desponding character. The house-coal trade, which during the past two months has been in a quiet state, shows no improvement. There is but little inquiry for house-coal for London, and the quantity of both Silkstones and Barnsley thick seam coal which is passing over the lines is only a limited one. No improvement can be noted with regard to the business doing with Lincolnshire and the eastern counties. Prices of nearly all kinds of coal are low, whilst the output is far in excess of the demand, although the pits are only working three and four days per week. Steam-coal, on the other hand, is said to be slightly improved in demand, and a fair tonnage is being sent by rail to Hull and Grimsby for shipment, as well as to various iron-smelting districts. Rather more is being done by water communication, freights being much the same as for some time past. The pending general election is the all-engrossing topic, and there can be no doubt that it has its influence on the state of trade in the West Riding and Lincolnshire manufacturing districts, to which engine coal is generally sent. The business doing in coke shows no falling off, either in demand or make, but it is to be feared that if the output is measured at the present rate it will soon alter the position of affairs. At many of the leading collieries the number of ovens are being increased at a rapid rate, some firms having now over 100 ovens at work. The Manchester and Sheffield Company are still conveying a very large tonnage to North Lincolnshire daily, the waggons returning loaded with iron ore for the use of the furnaces in Yorkshire. The tonnage rates are still the subject of grave complaints. During the week, Mr. W. Chappell, formerly agent of the Old South Yorkshire Miners' Association, and now chief of a new organisation in the Sheffield and Rotherham district, has, in conjunction, attended a mass meeting of working men at Hull, at which resolutions were passed pledging those present to support a memorial to Government asking for a Royal Commission to inquire into the rates charged for the conveyance of coal from South Yorkshire to Hull and other places. Although the district is in a pretty quiet state there are several disputes in existence at the Carlton Main Colliery; the men complain of what they call "confiscation" of corves, and have held a meeting on the subject, at which they appointed a deputation to wait on the owners, who of late have been compelled to appoint an inspector to look over the coal sent out on account of the dirty state in which some of it was sent to bank. The sliding scale seems to be on its last legs, owing to the variations which the men are from time to time wishful to impose. The iron trade is in much the same state as when last noticed. The furnaces at Milton, Elsecar, Thorncliffe and Parkgate are kept fully going, and two at Hepworth, near Penistone, which have been standing several years, are now advertised to let or sell. A very fair business is being done in merchant iron and Bessemer steel material, but taken as a whole the foundries are not fully employed, although in some instances they are fairly off for work.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—The quiet demand for hematite qualities of pig-iron reported during the past few weeks is still maintained, and there is no immediate prospect of a change for the better. It is expected by some that the spring and shipping season will introduce a revival, and this hope is to some extent justified by the fact that holders of second-hand qualities of pig-iron have not now a large tonnage of metal on hand, and many of them are assuming a much firmer attitude. Makers for about two months have done practically no business. Being well employed with the orders already in hand, and having sufficient work to keep their furnaces employed in most cases during the present year, they have to a great extent held aloof from the markets, and they are in most instances very firm in their transactions. While the value of hematite pig-iron is down as low as £5 5s. for all-round qualities of Bessemer iron, and while forge iron has come down to £4 17s. 6d. and £5, many makers are refusing to do business, except at fully £1 per ton in advance of these quotations. This is accepted as an evidence that makers can see a prospect of better values and an increased demand soon presenting themselves. There is a large business doing in Bessemer qualities of steel, and especially in railway material. The output of the district is considerably in excess of any previous period, and all the mills are kept regularly going. There are still efforts being made to develop other branches of the steel trade, with a view of introducing into the market steel plates and other steel products. Shipbuilders have now got fairly forward with a considerable quantity of the work they have in hand, and as a consequence they are employing an increased number of workmen, but there are still a large number of skilled and other workmen in want of employment. Engineers, boiler makers and waggon builders, are very busily employed. Iron ore is in fair request, and prices are steady at about 25s. per ton. The coal and coke trades are well employed. There is a large consumption, and prices are steady.

BIRMINGHAM.—Business in the hardware branches of local industry is still marked by a want of the animation which ordinarily characterises the opening of the spring season. It is only in a limited number of the numerous departments that manufacturers are reported to have their works fully employed, and even where this is the case the complaint is not unfrequent that little or no profit can be made out of the work on hand. The fact is that makers of finished goods have not succeeded in establishing advances on the articles they turn out at all proportionate to the rise which has taken place in the raw material, and hence, even at the best, they are working at a limited margin of profit. Matters, however, have become still more complicated by the extreme difficulty which is experienced in maintaining the standard of existing prices, and. here and there, firms who have been anxious to keep their machinery and their hands going on full time have had to consent to some little concession in order to secure sufficient orders for this purpose. For orders representing something like a fair extent of work some local houses engaged in the manufacture of travelling-boxes, tin-plate ware and hollow ware have been prepared to give way somewhat in the matter of prices, but these have been simply isolated cases, the result of individual action on the part of the firms concerned, and no general or formal reduction has taken place as yet. The improvement previously reported in the export trade has been fairly sustained. Business with the eastern markets has been unfavourably influenced by the adverse exchanges which have operated as a temporary check, but there has, nevertheless, been a fair request for railway carriage ironwork and one or two other specialties. A more plentiful supply of shipping orders has also come to hand from the Australian colonies and from South America, while Canadian buyers have been in the local market making purchases to a very fair extent of builders' hardware and different descriptions of fancy goods. A steady trade is also maintained with the Cape. In the home trade the principal feature of improvement is the slightly-increased demand for joiners' and other tools, and for builders' ironmongery generally which are coming from the metropolis and the larger towns, owing to the commencement of the building season. For furnishing hardware, on the other hand, there is only a dull request, and but little is yet doing in agricultural goods. Lamp and lamp stove manufacturers are pretty fully engaged on work to meet the requirements of next season, and saw makers are busy, especially on circular saws, for which there has been a brisk demand. In the nut and bolt trade there has been a good run on permanent-way fastenings, spikes, bolts, &c., but in the crank bolt and nut branch business has been somewhat slack. Plane makers are working principally for stock, and the trade is inactive. The same may be said of the machine and engineering departments, except as regards one or two leading firms, who have special orders of some extent on hand. Heavy ironfounding is reported in better demand, and nickel refiners and manufacturers of German silver have been kept engaged on old orders, new business showing, however, a perceptible falling off since the rise in prices at the commencement of the year. The local iron trade has felt the beneficial influence of the favourable movement reported from the Australian colonies owing to the gradual thinning down of stocks under a genuine consumptive demand, and the gradual rise in prices in the colonial markets which has been the necessary result. As the advance thus established has at length reached quite the level of the home market, colonial purchases have been re-commenced. Against this gratifying feature of the trade aspect we must, however, take into consideration the continued decadence of the United States demand and the depression of the home trade. These are more than sufficient to outweigh the favourable reaction in the colonial trade, and many manufacturers complain of want of employment, while even those whose books are pretty full do not find buyers anxious to accept delivery. This has led to some underselling, chiefly among the second-rate firms, who have in some cases conceded as much as 15s. per ton to secure a good line. Pig-iron has been quiet, but the local smelters, strong in the conviction that this is only a temporary and not unusual phase of trade after a brisk run, keep up prices so far as the best brands are concerned and are increasing the output. There is a hitch in the arrangements which, it was hoped, would put the question of ironworkers' wages in the district upon a permanently satisfactory footing, and although the difficulty is only of a temporary character, it is to be regretted as prolonging a condition which imports an element of uncertainty into the trade operations, which must operate unfavourably. In accordance with previous arrangement the question of the adoption of a sliding scale was considered at the meeting of the South Staffordshire Wages Board on Monday. The President (Mr. Chamberlain, M.P.), was unable to attend, owing to his election engagements, but on the masters' side it was proposed that the sales of iron should be taken out by an accountant, and that 1s. per pound per ton should be paid for puddling upon the average selling price after allowing the usual reductions and the customary discount. The men's proposal only differed from this in the fact that they asked that the additional 1s. should be on the ton weight. The masters, however, proposed that the calculation for the basis of the sliding scale should be made on the returns for March, April and May, instead of December, January and February, and that for the next three months the men should receive the current rate of wages. This was firmly declined by the men who asked 1s. advance on the existing rate during the three months for which the adoption of the sliding scale was postponed. They subsequently offered to accept 6d. per ton advance during this period, but the masters have refused to agree to this, the chairman remarking that the present state of trade looked so black that he was seriously afraid the present rate of wages could not even be maintained. Once more, therefore, the services of the president, arbitrator have to be called in, and Mr. Chamberlain has been asked to make his award at the earliest date convenient to himself. Some houses in the Wolverhampton district report the receipt, by last mail, of a fair bulk of orders from Cuba and Mexico, as well as a slight improvement in Canadian advices, and a more extended and varied list of orders from British India than has been the case for some weeks past. At home a movement is beginning to manifest itself for articles used in horticultural pursuits, and for galvanised wire netting; Walsall and Wednesbury tube manufacturers, though not busy, are fairly well employed on gas and water tubes, and the home demand for steam tubing is improving.

CLEVELAND.—The market was rather quiet on Tuesday, the borough election having engrossed the attention of most. Nos. 3 and forge 4 were done at 53s. immediate delivery, and 53s. 3d. as far forward as August. Makers, however, are mainly out of the market, and iron is scarce, Connal's warrants being chiefly drawn upon for the supply. The finished-iron trade is rather easier. Plates £8 12s. 6d. to £8 17s. 6d., common bars £7 15s. to £8; puddled bars £5 12s. 6d. to £5 15s. The shipbuilding trade is harassed with the labour difficulty. Messrs. Pearse and Co. of Stockton, following the example of Mr. Withey of Hartlepool, locked out the boiler makers from their yard and introduced ship-carpenters from Sunderland. The men resented this action by intimidation. The engineering trades are fairly well employed as also the foundries. The coal and coke trade is much the same as last week.

DERBYSHIRE.—Throughout this district the pending general election is the chief topic of interest, and there can be no doubt that business in both the iron and coal trades is influenced thereby. The ironworks, on the whole, do not exhibit any great alteration. Moulders, engineers and machine makers, although in some instances scarcely fully employed, have no cause for complaint. The make of pig-iron is fully up to the average, and in a short time the output will be augmented by the blowing-in of additional furnaces. Makers of Bessemer steel rails, tires, &c., are doing a fair stroke of business, chiefly on account of orders from a distance. The collieries are not so well employed as they were a short time ago, but at those places where large contracts are on hand work is pretty regularly prosecuted. The Midland are carrying a large tonnage of coal from the pits around Chesterfield, Clay Cross, Langley Mill, and other coal-producing districts. A fair quantity has also been sent from the collieries in the Erewash Valley district, as well as those in the outer circle of the Nottinghamshire coalfield. Steam qualities are just now moving, but the chief of what leaves the district is sent away for smelting purposes. The local trade is still subject to great competition, but no change can be noted in prices. There is a very fair enquiry for coke a good deal of which is sent to Sheffield and other places for the use of furnaces.

DURHAM.—The condition of trade has not improved, but the tendency has been in the other direction. There appears, on the part of some, less confidence just now. They are not able to gauge the future of the iron trade, and therefore are afraid either to buy or sell—to buy, lest prices should get lower; or to sell, lest they should speedily gain some, if not all, the ground they have lost within the past few weeks—and to many, if not all, so unexpectedly lost. Those who had bought iron on speculation for spring delivery at higher prices than now are current hardly know what course to take. To sell is to lose. Only a few of the more timid second-hands are, however, offering iron at present. The quotation by merchants for No. 3 is from 53s. to 54s. net. There is now a larger supply of forge pig than was the case a short time back. The conditions which apply to the pig-iron trade measurably also pertain to the finished iron. Business has been slack, and the demand has been very limited. Those who have orders hold back as long as possible. The manufacturers generally are pretty well booked, and do not, therefore, abate much in prices. As the merchants laid in good stocks, they are offering at lower rates, and bringing those manufacturers who want to enter the market down to their figures. The general prices current are:—Ship plates, £8 15s. to £9; bars, £7 15s. to £8; angle iron, £8; iron rails, £8 to £8 10s., less commission. There is a scarcity of workmen in some parts of the district. At Stockton the shipwrights have, in one case, struck; but other men have, in a considerable measure, been got to fill their place. The coke trade is very irregular, and prices are weaker, especially in the hands of second holders. The price of good Durham coke for early delivery is 15s., but a fine second-class coke can be got for 1s. per ton less. These are only in comparatively small lots; and coke-makers, like iron-makers, will not sell forward at the present low rates. There is no change worth noting in the coal trade.

FOREST OF DEAN.—The general election increases in interest, and locally the main issue is whether the constituency of West Gloucester shall be exclusively Liberal or half-and-half. There is some little derangement of trade as a result of the contest, and the respective partisans are active in setting forth their respective merits, blackballing, also, opponents. It is to be hoped the political strife may speedily subside, when hopes can again be directed to improvement of trade. The domestic fuel branch is still utterly devoid of life, and generally speaking the pits are not turning out half the tonnage they are capable of. The extra weight question at Messrs. Crawshay's collieries has been deferred for a month. On behalf of the firm it has been urged the additional 1 cwt. must be conceded, as the existing scale does not provide 20 cwt. per ton of clean domestic fuel. With the current low prices it is obvious that the proprietors must have some easements, experience teaching that this is inevitable if colliery proprietors are to carry on with any profit. The Parkend Collieries are still under suspense, and the employés without work. Regarding the fact that a large number of families are dependent upon these pits for work the stoppage will be seriously inconvenient for them. A meeting of the proprietary was held a few days ago, and the fact of continued suspense indicates too palpably an unfavourable outlook. The bright side to the matter is the continuance of pumping, and an intimation that the stoppage will not be of a protracted character. The pig-iron trade is affected by a general reaction, and prospects are less bright than they were. Quarter-day is anticipated as likely to re-animate the demand; but it will be scarcely wise to place too much hope therein. The iron ore branch continues brisk, and this industry has aided somewhat in compensating for the reaction in the coal trade. Prices remain firm. Iron wire and rods continue in good demand, and local production remains active. Tin-plates attract a fair degree of attention, the manufactories being fully engaged. There is very little interest attached to the building industry, and mechanics find their occupation considerable affected by the absence of prosperity now and during the last few years. Colliery proprietors are avoiding all kinds of expenditure in what is known as dead work, hence the staff of pit mechanics generally has fallen off. It may be added that Mr. Edwin Crawshay contemplates the re-opening of a colliery in the Whitecroft Valley, and will give employment to nearly 100 hands.

GLASGOW.—A further decline has taken place in the price of pig-iron warrants, and the market closes without animation. Holders, after experiencing heavy losses, still show a desire to clear out, as at present a lack of confidence exists regarding the future of pig-iron. Although large quantities of pig-iron are being shipped to the United States, few new orders are forthcoming, and buyers from all quarters seem to prefer a policy of waiting to see what will turn up. Of course the general election is distracting the attention of operators; when it is over it is generally expected that there will be some improvement. On Thursday the market was quiet at from 57s. 7½d. to 56s. 10½d. cash, and 58s. to 57s. 3d. a month. Next day some good buying set in, and the price rose to 58s. 6d. cash, and 58s. 9d. a month; but on Monday sellers again predominated, and from 58s. to 56s. 7½d. cash, and 58s. 6d. to 57s. a month was accepted. On Tuesday a good business was done from 56s. 9d. to 55s. 9d. cash, closing buyers, 55s. 9d. cash, and 56s. 1½d. a month, sellers 1½d. per ton more. The makers are finding their iron slow of sale, though they have already made considerable reduction in the price. Many of them, however, are busily employed in sending off iron bought some time ago. The shipments of pig-iron from Scotland last week were:—Foreign, 16,448 tons; coastwise, 4538 tons; total 20,987 tons, against 11,167 tons in the corresponding period of last year. The increase since Christmas now amounts to 66,152 tons over last year. The imports of Middlesborough pig-iron into Grangemouth last week were 3080 tons, against 5672 tons in the similar period of last year. The total imports till March 20th, 1880, are 60,462 tons, against 61,280 tons till March 22nd, 1879, showing a decrease for this year of 818 tons. The stock in Connal's store was reduced last week by 2402 tons, the stock now being 440,095 tons. Though the works in the malleable iron trade are well employed, there are few orders to be got, and prices have therefore been officially reduced a further 5s. per ton. The nominal quotations for common bars is £8 16s. per ton, but good orders could be placed at 10s. less. The exports last week were large, the chief items being, for the East, locomotives valued at £21,590; cast iron goods at £11,432; wrought iron at £2300. For the Continent, machinery at £6565, wrought iron at £3185 and sugar-mill machinery valued at £4700. The shipbuilders are still brisk, and orders for one or two small small vessels were obtained during the week. A number of engineers and founders complain that a lull has again come over their business, and that they are having no inquiries for new work. The steel company are very busy, and have had to refuse orders. The coal trade remains in a lifeless condition, and orders for either shipping or house coals are difficult to be got.

LANCASHIRE.—In the iron trade of this district the business doing during the past week has been of a very limited description, buyers as a rule believing that in the present unsettled state of the market there is nothing to be lost by waiting, and many orders which might otherwise be given out are consequently being held back. There has, however, been some speculative buying, and the present low prices have induced some of the machinists and engineers in this district to enter into purchases of Scotch warrants, but altogether the weight of iron changing hands has been very small. With regard to prices, there is generally a weaker tone so far as iron held in second hands is concerned, and makers' iron can in some cases be bought for rather less money than has been asked of late. Lancashire pig-iron is without material alteration from last week. Local makers are still asking for delivery into the Manchester district 70s. per ton, less 2½ per cent., for both foundry and forge iron; but there is scarcely anything doing, forge iron not meeting with anything like the demand it did, and nearly all the iron now going away is on account of old contracts, but these are still taking away most of the present production. Middlesborough irons coming into this district have been tending downwards in price during the past week, and G.M.B.'s for prompt delivery equal to Manchester have been offered at about 61s. 10d. per ton net cash, with sellers for forward delivery at about 63s. 4d. per ton. Lincolnshire iron in second hands is being offered for delivery here at about 70s. per ton less 2½ per cent, and orders could be placed with makers at 1s. to 2s. per ton above this, although they have still only a small quantity of iron to offer. Very little Derbyshire iron seems to be held by dealers, and makers being still well sold are not offering except at their full rates.

Although most of the finished-iron makers in this district are still well supplied with orders and not inclined to give way, there has been some underselling, and bars delivered into the Manchester district are to be bought at about £8 to £85 per ton; makers as a rule, however, are not willing to take under £8 10s. so many of them hold out for £9 per ton. Founders, engineers and machinists are being better supplied with orders, and generally they are looking forward to a fair amount of trade. The recent colder weather has created a slightly better inquiry for house-fire classes of fuel, but there has not been any increase in the amount of business to make itself appreciably felt in the market, which continues extremely dull. Stocks are still increasing and short time becoming more general. But whilst all classes of round coal are moving off very slowly, engine classes of fuel are in very good demand, and as slack is now generally becoming scarce consumers are being thrown more on to buying, and in these descriptions of fuel there is every indication of an advance next month. The quoted prices are without material change from last week, but in round coals there is an easier tone. Best Lancashire round coal at the pit mouth ranges about 8s. to 8s. 6d., seconds 6s. to 6s. 6d., common coal 5s. to 5s. 6d., burgy 4s. to 4s. 6d., good slack 3s. 6d., and common 2s. to 2s. 6d. per ton, but where sales of round coal are pressed even lower figures than the above are in some cases taken. In the shipping trade there is still but little doing.

LEEDS AND WEST YORKSHIRE.—The forges, which as a rule work four days a week, began operations on Monday morning in order to make up for Good Friday. It is quite certain that the Easter holidays will be next week very much shorter than they were a year ago. None of our ironmasters can afford above a couple of days next week, and some of them, we verily believe, are ready to begrudge that, for every day increases their confidence that for a considerable period to come, a safe and circumspect trade, like that which is peculiar to this district, will certainly expand. There is no change to note in the descriptions of work which the best Yorkshire iron makers have in hand. They have good orders for tires (both iron and steel) and axles, but strange to say, we seldom hear of any perquisition in the way of cranks, for the manufacture of which some of our forges used to be so pre-eminent. No satisfactory reason has yet been assigned for the falling off in this particular item, but probably it is that the railway companies overstocked themselves when the iron market was falling, and neither see the policy nor the necessity for at present acquiring fresh supplies. Upon boiler-plate there is quite as good a run yet as we have been describing in this report for several weeks past. Best brands of bar and other merchant iron continue to be made copiously, and in no inconsiderable proportions for foreign and colonial export. In transacting the best bars there is not much bargaining, for makers show the most rigid adherence to their highest quotations. The same is the case with reference to common iron. Locomotive builders are not only fully engaged in present orders, but have every reliable assurance of a continuation of sufficient work for the remainder of the year. There is no change for the better as regards agricultural machinery. Some Government orders for small tools have come into the district, and makers are tolerably busy, too, for miscellaneous customers. Nailmakers are obliged to work overtime, but prices admit only of the very barest profits. The coal trade is quieter and prices stationary. The greater number of pits are only working four days a week.

LONDON.—The metal market here presents a depressed aspect, and prices have receded all round. The telegrams from the North of a decline in pig-iron seem to have affected all departments of the metal trade, and caused a general hesitation. In pig-iron we have business done at 55s. warrants, at which the market closes. Manufactured quiet. Tin has still fallen, and foreign has been sold at £54, closing, however, a little better. Heavy holders, finding it desirable to realise, are pressing parcels freely on the market. This would account for the depression in most metals at the moment, including copper. Lead has taken the initiative in falling prices, but seems to have touched the bottom. A large quantity has been bought at £16. Tinplates quiet.

NEWCASTLE AND THE TYNE DISTRICT.—More attention has been paid to business this week in our neighbourhood, and less to electioneering, yet there is still much conversation on the probability, or otherwise, of a change of Government, and on the manner in which such a contingency would affect our commerce. The near approach of the Easter holidays has had the effect this week of hurrying shipments of all kinds of produce in our river, so as to get vessels despatched before the works and mines are closed. Little change has taken place in the pig-iron market since last week. The market has been very peculiar here, and subject to frequent and sudden, but not serious, fluctuations; but it closes a little better than it was towards the end of last week. Bars are in fair demand at £8; angles bring £8 10s. readily, and plates, which cannot be got quickly enough, are sold at £9 per ton. Forge work is in much demand this week, and good prices are secured, and have indeed been required by the recent advance in the price of scrap iron. The shipbuilding yards are still very busy, and are likely to remain so for many months to come, all the large firms having contracts in hand that will keep their places going, irrespective of all new orders that may come in before autumn. Several launches have taken place in the past few days, and in every case the keels of new vessels have been or are being put down. There is still a difficulty in getting plates from the makers in time to meet builders' requirements. Two large iron steamers are nearly ready for launching in the building yard of Messrs. J. Wigham Richardson and Co. at Low Walker, and several others are in progress. Engine and boiler works are all crowded with work, and so are the foundries. One of the largest engine-making firms on the Tyne has been compelled to give out some orders for engines, not being able to get them done in their own establishment. Messrs. Palmer's blast-furnaces and rolling mills at Jarrow are working to their utmost capability. The preparations for blowing in the second blast-furnace at Walker, noticed a fortnight ago, are nearly complete. The coal trade generally is steady, but not active this week more than is usually the case just previous to a holiday week. The navigation of the Baltic is not satisfactory as yet, and this tends to hinder business in that direction. Steadiness is the characteristic of the steam coal trade. A rise in prices is contemplated early in April; steamers, according to the present aspect of affairs, will then be loading for the lower Baltic ports, and some of the coal-owners think a rise of 1s. 6d. to 2s. per ton may then be safely put upon the best steam coals, but the general opinion is that the market will not bear an advance of more than 1s. per ton. Gas and coking coals are shipped in good quantity, but there is room for more demand, whilst house-coals are yet slow of sale, the buyer having the best of contract-bargains. The chemical trade is quiet; there have been no transactions of importance this week, but shipments on account of running contracts are progressing satisfactorily, so that stocks do not accumulate to any extent. A few sailing vessels are taking general cargoes, principally iron and chemicals, for America. Cement works and lead factories show no decrease in activity, and the plate glass-works keep fully employed.

NORTH STAFFORDSHIRE.—At a time when the country is passing through the turmoil of a general election it is hardly to be expected that business will be free from interruption, and the number of orders coming into this district for finished iron is small, although it is not below the average of several past weeks. The bar mills are still going full time, but this cannot be continued much longer unless the demand takes a turn for the better, of which there is no immediate prospect. The home market continues inactive, and there is no improvement in the foreign demand. Some of the speculating buyers are anxious to get rid of their contracts, and those who succeed are doing it, in most cases, at a loss. The plate mills are moderately off, but the demand for hoops is not so brisk. Prices generally are weaker, and quotations for good lots are made at reduced figures. The pig-iron market shows a considerable falling off in the sales, but puddled bars are in good demand. Inquiries for ironstone are few, and the supply of coal is much in excess of consumption, while prices rule low.

SHEFFIELD.—Whether it is owing to the present political disturbances in the country or not is matter for conjecture, but there can be no doubt business is duller than was the case a month ago. The iron market is heavy and rather drooping. Buyers are asking for concessions, but these are resisted by holders. No doubt there has been a considerable amount of over speculation during the past few months, and the market has to recover from this. Heavy stocks of better-class iron are held in the hope of a rise. Commoner descriptions are selling more freely, and Derbyshire and Northamptonshire makes are realising a paying price. Some of the smelters have old contracts yet on hand, uncompleted, and when these have been fulfilled it is hoped the results of better trade will be more felt. There is a considerable degree of uncertainty in some commercial circles, and not a slight degree of uneasiness. The money market was tight, and no extension of business operations may be looked for until after the elections have passed. Large purchases have been made of foreign iron, and this tends to keep up rates. Prices of manufactured iron are not, however, as yet, commensurate with the increased cost of the raw material, and some radical changes in rates will have to take place before the iron trade can be said to be in a prosperous condition. Bessemer steel has fallen a shade in value, but this is only in cases where holders are realising off stocks to meet bills given for forward purchases some six months ago. Some ridiculous quotations for Bessemer steel have recently been current. The prices of the day are: Best marked Bessemer ingots, at works, £11 10s.; second class, £11; ordinary ingots, £9 15s. These rates are maintained as the net rates of the day. Billets, used for saws, &c., are 5 per cent. cheaper, and in poor demand. Latterly there has been a large consumption of Siemens-Martin steel for wire purposes, and this has sent up prices. Qualities quoted in October last, £9 per ton, are to-day realising £14 10s. With rail-ends fetching £7 per ton, by tender—as was the case with one of our leading railways this week—it is evident that when Bessemer steel in ingot is quoted at £6. per ton, as has been the case this week, an egregious error has been made. Bessemer steels will hold their past value for some time to come, and possibly will advance. Business in the old staple trades appears to come by "fits and starts." This week a number of cutlery manufacturers are complaining that orders have again fallen off. This is true. Large orders of heavy cutlery for the colonies are being witheld in Liverpool, Birmingham, and Manchester, pending the result of the elections. Though business and politics may appear to have no connection, yet it is evident they have, and until thepolitical disturbance has subsided it is feared there will be little amendment of trade to report.

SOUTH STAFFORDSHIRE.—The factories are this week pushing ahead to get out all the work that is possible before, by reason of the Easter holidays, business is suspended. Stock-taking will in the interval occupy the attention of some manufacturers. The mail delivered this week from Cuba and Mexico is fairly encouraging, and both the Canadian and Australian trades are improving. Japannese and tin-plate workers are doing a steady season trade in travelling-trunks, baths, toilet sets, and the like, but it cannot be reported as of average extent. The fender and fire-iron trade is not active, but here and there a little more is doing with Australia. Black iron odd work, such as washers, chest handles, kettle and bucket ears, and box clips, is finding four days' a week employment for the bulk of the masters, while some others are making full time. Cotton ties are in undiminished inquiry on American account, and manufacturers believe that the demand will continue. The lock trade as a whole is quiet, whether the Wolverhampton, the Willenhall, or the Walsall makers be spoken of. Ironfounders are well employed on mill and forge work, but in the engineering department the improvement is slight. The iron trade is feeling the usual quietening effects of the near approach of the quarterly meetings, which are fixed for the 7th and 8th of next month. Prices are without change.

WEST CUMBERLAND.—The week's business in hematite pig-iron has been up to late averages, and it is noteworthy that a large proportion of the hematite iron held by merchants, second-hand dealers and others, the sale of which for some time past has had the effect of pulling down prices, is getting into smaller compass, and makers are anticipating being able to realise better prices in the course of a few weeks. They are in receipt of a large number of orders, and their works will be well employed for some months to come if no new contracts are entered into. Numerous inquiries are being made from Russia and other countries on the Continent, but the American demand is still inconsiderable. On home account, however, a fair business is doing. New furnaces are being erected, and there is a steady growth in the producing power of the district. Prices of iron are difficult to quote, for while on the one hand sales of Bessemer iron have been made at a trifle over £5 per ton; on the other hand, makers in many cases refuse altogether to negotiate business at less than £5 12s. 9d. per ton. Steel-makers have their hands practically full of orders, and their works are still very fully employed. Prices range from £9 15s. to £10 10s. per ton for steel rails. A very considerable quantity of metal is being shipped to America, Australia and elsewhere; and it is certain this year will witness considerable activity in the shipping trade. The finished-iron trade is well furnished with work, and makers keep their mills employed night and day, and are nevertheless behind-hand with deliveries. At most works extensions are being made. Puddled bars, rivet iron and bars are in considerable request; and a class of iron mixed with steel finds considerable favour. There are signs of a very marked revival in the shipbuilding trade of the district. Iron ore is in good request, and sales are noted at from 25s. to 30s. per ton at the mines. There is a quiet tone in the coal trade, inasmuch as the demand, to a great extent, is confined to the consumption of the district. Only a small tonnage, comparatively speaking, is shipped to Ireland.

CONTINENTAL MINING AND METALLURGY.

CONTINENTAL markets have had much the same aspect during the week just past as during the week preceding it. A period of indecision has set in, owing, as is reported from each country severally, excepting Austria, to the action of intermediaries who are now approaching the end of the deliveries they had contracted for speculatively at the beginning of the revival, and are therefore more desirous of selling than to keep up the tone of the market. Consumption is going on steadily, and is not checked by the constant political uneasiness of the Continent, which is discounted as merely superficial. And rumours of a renewal of American demand have begun to make their way through foreign metal exchanges.

FRANCE.

La Métallurgie advises its readers to study the fluctuations of the American market which bids fair to become the regulator for iron as it is already for corn. "American demands falling off, lead to a decline in English rates, and that to a fall in our own. One of the bases of the American demand is the exportation of American wheat to Europe. The mere probability of a good harvest in France will therefore tend to diminish American exports of grain, and consequently American imports of iron. We cannot, of course, presage what our next harvest will bring forth, but we may well hope that it will be a better one than last year's, which was exceptionally disastrous. Probably we may expect a falling off in American grain exports, and therefore a slackening of rates on European exchanges. The depreciation will be less felt in France than elsewhere by reason of the protective duties which secure the home market to home producers, and because of the important public works still in hand."

At the meeting of Nord forgemasters held on the 11th inst. at Maubeuge, it was resolved not to go beyond 240 fr. (£9 12s.) for merchant iron, 250 fr. (£10) for beams, and £12 for plates. A rise in beams is thought probable; they may reach 270 fr. or 280 fr., but for merchant irons the maximum present limit is fixed at 250 fr. (£10). Mills are fairly full till next October. The neighbouring department of Haute-Marne is now 10 fr. ahead of the Nord for merchant bars. The next meeting of Nord forgemasters is to take place on April 8th, at Valenciennes.

Two contracts for rails have been let during the week at advantageous terms. The first, for 9000 tons of Vignoles steel rails, 25 kilos the metre run, was let at 320 fr. (£12 16s.), delivered at Marseilles, the second, for 3000 tons of Vignoles iron rails, at 280 fr. (£9 4s.), delivered at Paris. The rails for the new railway between Chateaubriand and Rennes, which were withdrawn last April, were lately put up again to tender, and let to Creusot at £13 10s.—an advance of 2 per cent. on the Creusot offer before rejected. Plant for the new railway between Auxerre and Gien was recently offered at an upset estimate on which all tenders were largely in advance, and all offers have been declined.

Haute-Marne appears to have no reason to envy any longer the prosperity of the Nord. Speculative action has had a smaller effect in the former than in the latter department, and makers are accordingly getting better crops of profit off to-day's markets. Ironworks of every category are in full swing. Points are difficult to get, the frost having stopped manufacture during the period when stock is usually got up, and all that is sent away has to be made as wanted. Many houses, says *La Métallurgie*, reply to inquiries by rates which are not so much business quotations as an evasion of business. It is not likely that any increase will be made on the No. 4 list issued by the chainmakers' Comptoir. Iron bedsteads are in such brisk demand that a rise is inevitable, and castings are tending upwards.

News is given by *Le Charbon* of metallurgical operations in the extreme West of France. The resources of Brittany are enlarged by the Tabago blast-furnace (Ile-et-Vilaine), at which Mr. Haentjens, the new managers of the Marquise Company, is about to start on foundry pig. Two other blast-furnaces are to be built ready for operations in October, the plant coming from Creusot. Parallel with these undertakings the Port of Bellion is to be put into order for the loading on board ship of the Tabago make, and the unloading of English coke.

The firmness of which Creusot, in an above-mentioned tender, has given proof, has been accepted as a good omen by the steelmasters of the Centre, and has been interpreted as a proof that the present halt in prices is not a definitive stoppage of their advance. The city of Tours has just borrowed £120,000, part of which is to be expended in improving the waterworks, building covered markets, &c. A considerable weight of castings will very likely be called for. Two engineers belonging to a large Centre steelworks have lately come home from a two months' tour in Russia, where they are believed to have been engaged, not in looking for orders, but ironstone. It seems a bad time of year for mineralogical exploration.

The dephosphorisation notes of the week comprise from France the proposed adoption of the Thomas process by the Providence works at Hautmont; the proximate establishment of dephosphorisation works on the Meuse, as near Longwy as possible, by the Longwy syndicate of ironmasters, to start in 1881; the purchase of a field of ironstone at Hussigay (Meurthe-et-Moselle) by the Denain and Anzin works, and the erection by them of two Bessemer furnaces at Denain. The report is repeated that De Wendel and Schneider are joint owners of very large works to be established at Joeuf, near Briey.

The Department of Mines has completed its statistical labours for 1879 by publishing the returns of the iron and coal trades for the second half. They are generally complained of as being ill-digested, and we are content to refer our readers for particulars of the iron trade of France during 1879 to the conscientious compilations of the Comité des Forges, of which we gave an abstract in our issue of the 5th inst.

A very well written account from the pen of M. Lan, of the metallurgical exhibits at Paris last year, is published in the February number of the Bulletin of the Société d'Encouragement. The author is strongly of opinion that the Bessemer converter, especially in its latest phase, is the best possible instrument for the preliminary purification of pig-metal, the final conversion of which he seems to think best effected by the hearth process.

The Minister of Public Works recounts in the *Journal officiel* of the latter, the accidents which happened with steam boilers in 1878 (the year before last). The accidents officially reported on were 35 in number; they involved the loss of 37 lives, 31 cases of bodily injury. The scantiness as well as the lateness of the information vouchsafed by the Minister have been the subject of hostile remarks in technical papers.

Our French contemporaries recognise in the opening of the St. Gothard tunnel a great advantage for commercial interchange between the North and the South, but particularly between Germany, Belgium, Holland and England and the South and East, the present line of traffic from Brindisi to Calais being in danger of being supplanted by lines from Brindisi to Antwerp and Hamburg.

BELGIUM.—The decline in Scotch warrants has not, it is contended, had much influence on the prices of Belgium pig, which keeps up at Charleroi at £4 for No. 5 grey, and £3 16s. for white forge. Inquiries have certainly slackened during the past three or four weeks, and the fresh impulse to trade which usually accompanies the incoming of spring has not made itself felt as yet. This, however, does not seem to us surprising, the usual course of the distribution of business having been deranged by the eager operations with which the present year opened. There are considerable contracts, it is believed, awaiting renewal, which will be negotiated as soon as the market has recovered stability. Bar mills have here and there relaxed rates, and have contracted at less than the £8 which remains the nominal standard, but makers of profile irons are secured for some months against any temptation to tamper with the market course. The course of business generally seems more favourable in Hainault than in Liége. The Providence escapade has left no trace; it would scarcely have had the effect it did, but for the slowness of spring orders to make their appearance. Steel remains inflexible, and rail mills are just now among the most profitably occupied of industrial undertakings. The price of scrap is maintained. For 326 tons of old fishplates the Monceau Ironworks have just offered £4 10s.; the next lower offer being £4 4s. A Hay firm offered for 800 tons of old chairs at prices ranging from £3 5s. to £3 14s. Waggon-builders are still waiting for the decision of the State with respect to the 2000 new trucks and vans which it is stated are necessary for the proper equipment of the State railways. The *Cote libre*, indeed, puts the number necessary at from 2000 to 3500; but it seems difficult to imagine how business can go on at all with so large a defect as this statement implies in such necessary *matériel*. The statement is made by the Brussels *Intérêts* that if a goods truck runs for an average of a fortnight a year, it pays back the interest of the capital sunk in it.

Technological news is scarce: M. Stas has reported to the Belgian Royal Academy on Professor Secchi's discovery of the new body, *vesbium*, which has been separated from parcels of lava thrown out by Vesuvius in 1631. The new body takes rank between molybdenum and vanadium.

Coal-getting is going on steadily; there are no hands wanting occupation, and the probabilities are that as the time for field work comes on there will be vacancies to fill. A good many contracts are now being deputed; the glass trade is in an exceptionally prosperous condition, and brick makers' demands are large. Sugar boilers, on the other hand, are less pressing. Rates for water carriage to France are complained of as unduly high. Coke is bought freely, and before long all the old stock will have disappeared.

GERMANY.—The difficulty of the situation will have been sufficiently met in Germany if makers continue in their present course of maintaining prices with a firm hand until speculators' stocks have come to an end. The last week has seen no decline in prices, and we may conclude that makers will abstain from offering until consumers have disposed of the "rump" of speculation. Mills in Dortmund still receive offers which they only accept on condition of delivery being deferred to ten or twelve weeks from receipt of order. The activity has spread from the furnaces and mills to the various branches of engineering, which are busy not only on repairs but the manufacture of new plant for various industrial undertakings. Taken all together, therefore, the decline in rates can hardly be said to have affected manufacturers, and it will have disappeared before the latter becomes again dependent on the market.

At Baden tenders were let last week for 200 tires. The Phœnix Works asked £13 for fine-grained iron; Borsig £13 10s. for Martin steel, and Hörde £14 for cast steel. At Frankfort, on the 10th inst., a tender for 1100 tons of steel rails, were let to the Union Works, Dortmund, at £12 2s., Hörde asking £12 10s. De Wendel took on the same occasion 1327 tons of metallic sleepers at £8 10s., delivery in September. For delivery in October 5s. less per ton would have been taken by the contracting firm. New specifications for 15,000 tons of rail or the Moselle railway and for 40,000 tons for the Nassau and Pomeranian Railway are now being drawn up. During 1878 and 1879 the German railway lines absorbed 7380 vehicles, being at the rate of 3690 a year. The carriage-building works of Germany fully occupied would turn out 10,000 vehicles yearly, the home consumption being much below this amount, and foreign trade being rendered difficult by reason of the indirect action of the German import dues, a decline in this branch of industry is thought probable.

The Bochum Steelworks are so pressed with business as to have night as well as day shifts. These works are credited with the intention of adopting the Thomas-Gilchrist process for the manufacturing mild steel.

Quotations (maximum) rates on the 16th inst. at Dortmund and Düsseldorf respectively were as follows:—

	Dortmund.	Düsseldorf.
No. 1 spiegel	135s.	130s.
German foundry pig	105s.	100s.
„ Bessemer pig	115s.	115s.
Bars	210s.	210s.
Angles	215s.	—
Beams	210s.	—
Boiler plate	275s.	275s.
Bessemer rails	252s.	—

The German Forgemasters' Association finds that 160 German works employed 91,606 men in January, 1879, many on half time only, and 100,195 in January of the present year.

The iron trade of Lorraine is becoming every year more considerable. At the present time there are 17 furnaces on blast in the province, as against 14 in the spring of last year, and from 8000 to 9000 hands are fully occupied. At the new works spoken of above, founded by De Wendel, preparations are being actively pushed for the manufacture of steel; and the De Wendel and Schneider steelworks at Joeuf, close to the German frontier, will work up Lorraine pig. The ironstone deposits of the province are therefore rising in value, and are beginning to be appreciated by Westphalian ironmasters amongst others. On behalf of a group of Westphalian ironmasters, borings are being undertaken in a field of ironstone, valued at £25,000. In all, there have been let 183 fields in Lorraine, with a surface of 40,995 hectares; before 1870 there were 13 fields let, covering only 8538 hectares. In the hands of Lorraine ironmasters are 40 fields; in those of ironmasters from Rhineland, Westphalia, and Luxembourg, 74; and in the hands of private proprietors, 69. The rock-salt trade is another special industry of the province which has made great advances lately.

AUSTRIA.—Some modifications of the patent-law of Austria came into force on the 1st inst. It will no longer be necessary for foreigners to give proof of the validity of their original patent, nor will they be compelled to show that their process has received the sanction of practice. Provided only that, in case such patent claim is contested, proof of both will have to be adduced.

THE LABOUR MARKET.—The annual meeting of the South Staffordshire Iron Trade Wages Board, which regulates the rate of wages in the iron trade throughout England, was held on Monday at the Queen's Hotel, Birmingham, Mr. Hunt in the chair. The annual report stated that the board had been found of great advantage to the trade. For the future it would be self-acting, as the sliding-scale would come into use. The report was adopted, and the chairman then proposed that the question of settling the sliding-scale should be postponed, and that wages should remain as they are now for the next three months. Mr. Chamberlain, the president of the board, was too much engaged at present to give any attention to the Wages Board, and the difficulty in fixing upon a sliding-scale must therefore be postponed. The proposition of the masters was that 1s. per ton for puddling should be paid upon the average selling price, and the proposition of the men was that 1s. should be added. A shilling on pounds was the proposition of the masters, and 1s. on pounds with 1s. added, the proposition of the men. Mr. Capper, the operatives' secretary, said he could not agree to the proposition of the chairman, for he had been instructed to ask for an increase of wages of 1s. a ton for the next three months, and for the question of a sliding-scale to be kept in abeyance during that time. No resolution was come to, and after a conference of the masters it was decided to leave the question of wages open until Mr. Chamberlain, M.P., can find time to arbitrate.—The iron shipbuilders at Stockton have been locked out owing to a wages dispute, and carpenters have been engaged to do their work. These latter arrived on Monday morning, and were immediately attacked by the locked-out men, who kicked and beat several of them severely, despite their being escorted by large bodies of police. One man they attempted to throw into the Tees. He was only saved by the police. Great rioting and excitement prevailed, and several ringleaders were taken into custody. On Tuesday afternoon another riot broke out among the locked-out iron shipbuilders and the new hands employed in the same branch of trade. Several men were injured by blows from stones, which were thrown freely, and one man and a child were seriously hurt. The disturbance was ultimately quelled by the arrival of a body of police.—Owing to the refusal of the Consett Iron Company to give the putters an advance of 2½d. upon the present score price, they struck work on Tuesday, and the rest of the workmen being unable to work without them, all hands were thrown idle. The men employed at Redwell Hills Colliery also struck work on Tuesday, a difficulty having occurred about weighing the coals sent out of the mine.—With the object of securing an advance in wages from 33s. to £2 per week, the miners employed at Mr. M. Kennedy's, Ronhead Mines, near Barrow-in-Furness, have struck work to the number of 400, but their employer firmly declines to accede to their demands. The Barrow Hematite Company's miners at Park are agitating for an advance in wages. It is probable they will come to an arrangement with their employers without the necessity of a strike.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1119 to No. 1234, being the entries from March 16th, to March 22nd.

NEW APPLICATIONS.

Apparatus for Reading Microscopic Photographs.—A communication.—*W. R. Lake, London.* [1217
Attaching Buttons to Dress.—*T. Shutt, Birmingham.* [1208
Bag Furniture, &c.—*J. A. Thümling, London.* [1147
Ballasting Ships.—*M. Stuart, Seaforth, Lancashire.* [1153
Bankers' Cheques.—*E. Berman, London.* [1121
Bankers' Cheques.—*T. Denham, Halifax.* [1145
Bicycles.—*W. Bown and J. H. Hughes, Birmingham.* [1227
Bolting Machines.—*J. Griffiths, Weobley, Hereford.* [1137
Bottle-making Apparatus.—*H. Codd, London, and H. Barrett, Hampton.* [1161
Bouquet Holder.—*E. C. Girard-Thibault, Paris.* [1163
Brickmaking.—*J. D. Lampard, London.* [1159
Brooches, Lockets, &c.—*J. Walker, Birmingham.* [1171
Button-making Machinery.—*G. L. Aston and A. Homes, Birmingham.* [1165
Cask-Cleansing Machines.—*H. Hill, Weymouth.* [1140
Charging Gas Retorts.—*J. West, Maidstone, Kent.* [1221
Chill Casting.—*S. B. Whitfield, Birmingham.* [1170
Cleaning Hides.—*S. Gasc and A. Mader, Paris.* [1229
Coal-Lowering Machinery.—*J. Dunn, South Hetton, Durham.* [1183
Coiler Cans.—A communication.—*G. W. von Nawrocki, Berlin, Germany.* [1232
Collapsible Tube Valve.—*W. Wilson, Oakland, U.S.A.* [1162
Combination of Rail and Wheel.—A communication.—*H. Wedekind, London.* [1185
Cover for Carding Engines.—A communication.—*B. A. Dobson, Bolton, Lancashire.* [1174
Cooking Ranges.—*D. Dow, Falkirk, Stirlingshire.* [1189
Cupola Furnaces.—A communication.—*G. W. von Nawrocki, Berlin.* [1206
Cutting Paper, &c.—A communication.—*E. A. Brydges, Berlin.* [1135
Detonating Railway Signals.—*T. Barrow, Liverpool.* [1133
Disinfecting Apparatus.—*J. H. Nelson and F. Somers, Leeds, Yorkshire.* [1197
Dredger Buckets.—*W. Bagshawe, Newcastle-on-Tyne.* [1130
Driving Belts.—*J. Heap, Ashton-under Lyne.* [1193
Driving Chains.—*H. Renold, Manchester.* [1219
Dyeing and Printing Colours.—A communication.—*J. H. Johnson, London.* [1177
Dynamo-Electric Machine.—*J. Perry, London.* [1178
Electrical Fire Alarms.—*C. E. Spagnoletti, London.* [1212
Elevators.—*J. Stanhope, Liverpool.* [1122
Expansion Valve.—*G. Cranstoun, Birmingham.* [1169
Fastening Shuttle Tips.—*G. Snow, Hyde, Cheshire.* [1209
Forges.—*T. W. Chapman, London.* [1134
Fraud-Preventing Paper.—*A. Annandale, Dunbar, Haddington.* [1200
Furnaces.—A communication.—*J. H Johnson, London.* [1146
Fustians and Cords.—*D. Dewhirst and S. Crossley, Hebden Bridge, Yorkshire.* [1215
Galvanic Batteries.—A communication.—*A. M. Clark, Chancery Lane, London.* [1214
Gas Apparatus.—*G. E. Stevenson, Peterborough.* [1202
Gas Engines.—*R. Johnson, Seedley, near Manchester.* [1131
Gas Generators.—A communication.—*C. Pieper, Berlin.* [1220
Gas Kilns.—A communication.—*H. Wedekind, London.* [1191
Gas Purifying Apparatus.—*W. Foulis, Glasgow.* [1119
Glass Manufacture.—A communication.—*W. R. Lake, London.* [1105
Grinding and Cutting Apparatus.—A communication.—*H. J. Haddan, London.* [1128
Guards for Circular Saws.—*R. W. Tayler, Bury St. Edmunds, Suffolk.* [1156
Hair Restorers.—*S. W. Rich, Croydon.* [1103
Horse-shoe Nails.—A communication.—*W. R. Lake, London.* [1168
Horse-shoe Nails.—A communication.—*W. R. Lake, London.* [1210
Hot Blast Ovens.—A communication.—*G. Barker, Birmingham.* [1225
Indicators for Prime Movers.—*J. Casartelli, Manchester.* [1211
Insulating Telegraph Wires.—A communication.—*J. T. King, Liverpool.* [1184
Kilting Machines.—*T. Ashburn, Handsworth.* [1201
Knife Cleaning Machines.—*J. F. Walters, London.* [1196
Landing Gravel, &c.—*Sir John Coode, London.* [1176
Liquid Fuel Apparatus.—A communication.—*W. R. Lake, London.* [1142
Liquid Meters.—A communication.—*H. J. Haddan, London.* [1126
Looms.—*D. Armitage, Longwood, near Huddersfield.* [1231
Looms.—*J. Tayler, jun., Clithero, Lancashire.* [1144
Magneto-Electric Machines.—A communication.—*J. H. Johnson, London.* [1136
Marine Engine Governors.—A communication.—*H. H. Lake, London.* [1198
Metal Washers.—*R. Hay, Motherwell, Lanarkshire.* [1223
Microscopic Photographs.—A communication.—*W. R. Lake, London.* [1216
Micro-Telephone.—*R. H. Courtenay, London.* [1151
Motive Power Transmitter.—*A. M. Blair and C. Fairbairn, Manchester.* [1166
Mottled Paper.—*A. Annandale, Dunbar, Haddingtonshire.* [1180
Oiling and Scouring Wool.—A communication.—*W. R. Lake, London.* [1182
Paper-making Engine.—*W. Umpherston, Leith.* [1150
Portable Folding Desk and Seat.—*W. Fleming, Dublin.* [1167
Preventing Boiler Incrustation.—A communication.—*H. J. Haddan, London.* [1127
Printers' Quoin.—*P. de Villiers, St. Leonard's-on-Sea.* [1173
Printing Yarns.—*W. Aitken and A. Dickinson, Halifax.* [1233
Railway Apparatus.—*P. Black, jun., London.* [1207
Railway Brakes.—*S. G. Colquhoun, Edinburgh.* [1172
Railway Signalling.—*W. King, Houston, Renfrewshire.* [1139
Refrigerating Apparatus.—*A. D. Bryce-Douglas, Burnbrae, Dumbartonshire.* [1188
Reeling and Twisting Machines.—*W. Greatwich, Kidderminster, Worcestershire.* [1158
Rotary Engines.—*C. Menard, Paris.* [1204
Rotary Engines.—*J. Walker, Glasgow.* [1194
Rotary Engines.—*W. Ullmer, jun., London.* [1179
Rotary Pumps.—*C. Shaw, Wolverhampton.* [1164
Safety Appliances for Railways.—A communication.—*J. C. Mewburn, London.* [1125
Safety Hooks for Mine Cages.—*J. Foster and W. Brindle, Shevington, near Wigan, Lancashire.* [1187
Salt-Cake Pots.—*W. Fidler, Liverpool.* [1203
Saving Life and Property at Sea.—*J. Sample, Blyth, Northumberland.* [1213
Saws.—*R. Wyburn, London.* [1107
Sea-Water Distilling Apparatus.—*S. Willoughby, Plymouth, Devonshire.* [1228
Securing Liquids in Bottles.—*C. W. Morley, London.* [1138
Securing Waggon Wheels.—*G. Glossop and E. J. Cavill, Sheffield.* [1132
Shears.—*H. Turton, Sheffield.* [1190
Sighting Ordnance.—*L. K. Scott, London.* [1218
Slag Products.—*C. L. A. Bantsch, London.* [1141
Smoothing Plate Glass.—*W. W. Pilkington, St. Helen's, Lancashire.* [1154
Steam Boiler Scrapers.—*G. Preston, Manchester.* [1230
Steam Boilers.—*E. H. McNiel, Groton, U.S.A.* [1123
Steam Cultivation.—*T. Cooper, Great Ryburgh, Norfolk.* [1226
Steam Engine.—*S. W. Wilkinson and J. B. Hamond, Stockport,*

Steam Engines.—*W. Prowett, Fosters Booth, near Towcester, Northamptonshire.* [1222
Spinning Apparatus.—*J. Marsh and J. A. Marsh, Ashton-under-Lyne, Lancashire.* [1152
Spinning Frames.—*B. A. Dobson, Bolton, Lancashire.* [1175
Cheshire, and F. Preston, Huddersfield. [1214
Stopping Bottles.—*L. E. Chagniat, London.* [1224
Supporting Rails.—*J. Davidson, Wombwell, Yorkshire.* [1129
Tell-Tale.—*A. Hilfiker, London.* [1157
Ticket Apparatus.—*J. N. Maskelyne, London.* [1148
Tin-Plate Manufacture.—*E. Parry, London, and T. H. Cobley, Dunstable.* [1120
Velocipedes.—*N. Salamon, London.* [1160
Velocipedes.—*T. M. Gubbard and J. Mangnall, Manchester* [1205
Vertical Steam Boilers.—*W. Clark, Gateshead-on-Tyne, and W. M. Swanson, Willington-on-Tyne.* [1155
Vessel for Removing Night-Soil.—A communication.—*E. de Pass, London.* [1185
Washing of Gases and Vapours.—A communication.—*A. M. Clark, London.* [1181
Water Meter Valves.—*P. Hamer, Skegness, Lincolnshire.* [1121
Weaving.—*J. Poole, Bradford.* [1143
Zinc Manufacture.—A communication.—*S. Pitt, Sutton, Surrey.* [1149

COMMERCIAL.

MESSRS. ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

THE fall in the prices of iron, and the near approach of the Easter holidays has caused a dulness in iron freights and less chartering has been done this week.

Steam tonnage has been fixed from Cardiff to Montreal at 13s. per ton, to load new rails for the opening of the navigation, and a boat has excepted 9s. per ton pig-iron from Maryport to Rotterdam.

Sailing vessels have been chartered from Cardiff to New York at 11s. per ton rails, and one for a part cargo of rails, and remainder spiegel at 11s. 6d. and 5 per cent. per ton. From Newport to Figueria 14s. per ton has been done for a cargo of new rails. The prevailing easterly winds have prevented the arrival of many American sailing vessels, but a ship has been fixed to load next month from London to New York with old rails at 9s. per ton.

London, 23rd. March, 1880.

JAMES H. WEAGER AND CO.'S METAL REPORT.

A SUDDEN relapse has taken place in most metals, causing some alarm to heavy holders, and parcels have been forced for sale, which has had the effect of still further inducing depression. There is little doubt, however, but that this aspect of affairs is more indicative of the weakness of operators than the weakness of the market. Statistically, we contend that the recent drop in values does not show a falling away of business, and holders who can afford to wait, we are inclined to think, will profit by it. Iron advices bring us the intelligence of a fall to 55s. for pig, Scotch warrants, and less inclination to buy. Manufactured iron dull. Copper quiet. Chili bars £66. At Swansea ticketing, 1254 tons ore were sold at 13s. 4½d. for 9½ per cent. produce. Tin: Heavy holders coming into the market have forced down prices; foreign, however, taking the lead. Straits and Australian sold as low as £84, but since then the market has improved slightly, £84 10s. having been paid. English tin less inclined to drop. Ingots £92 to £93. Lead: A large quantity has been sold at £16 to £16 5s., and there are still buyers at these prices. The opinion obtains that we have seen the bottom in this metal. Certainly Continental dealers are holding for much higher prices. Tinplates are quiet. Cokes are offered at all sorts of prices, from 23s. to 27s. Our present quotations for metals are:—Iron.—Bars, Staffordshire, £8 5s. to £9 per ton; hoops, £9 5s. to £9 10s.; sheets, £10 5s. to £11 per ton. Copper.—Chili slabs for 96 per cent., £66 per ton; English ingots, £73; English sheets, sheathing and rods, £79 per ton; yellow metal sheets and sheathing, 6½d. per lb. Tin.—English ingots and blocks, £92 per ton; English bars, 4 cwt. barrels, £93; foreign, Straits, £84 10s.; Australian, £84 10s. per ton. Tinplates.—Coke, 25s. to 26s. per box; charcoal, 28s. to 30s. per box. Lead.—Spanish pig, £16 15s. per ton; English pig, £16 10s.; bars, £17; pipe, £18; sheets, £17 10s. per ton. Zinc, £23 10s. per ton. Spelter, £20 10s. per ton. Antimony, £72 per ton. Quicksilver, £7 per bottle.

26, Leadenhall Street, E.C.

SCOTCH PIG-IRON.

ANNEXED is a weekly statement of the shipments during this and the previous three years:—

Week end.	1880 Tons	1879 Tons	1878 Tons	1877 Tons
Jan. 3 ..	6677	4655	2441	3454
10 ..	6689	6069	6085	6500
17 ..	12,288	6291	4532	5141
24 ..	7566	6331	6170	7040
31 ..	13,383	4969	6550	5297
Feb. 7 ..	14,190	6130	5637	6183
14 ..	10,612	7272	5722	5839
21 ..	15,152	8996	5124	6559
28 ..	12,603	8318	7836	8630
March 6 ..	17,968	13,910	6816	8048
,, 13 ..	20,985	10,743	8662	7280
,, 20 ..	20,987	11,167	7725	9312
Total ..	162,100	94,851	73,300	77,483

THE "WORKSHOP" DAYLIGHT REFLECTOR.—To supersede gas or lamp light in daytime. Manufactured for 25s., complete.—(I.) Chappuis, Patentee, 69, Fleet Street, London.—[ADVT.]

PARTNERSHIPS DISSOLVED.

Marston Brothers, Birmingham, hardware merchants.—Gaffey and Ball, Manchester, glass mould manufacturers.—Day and Arundale, Birmingham, harness furniture manufacturers.—J. W. and G. F. Lasenby, Peterborough, washing machine manufacturers.—Bradby, Robins and Son, Gresham-house, City, and Southampton, solicitors.—J. Barwell, Son and Fisher, Birmingham, gas fittings manufacturers; as far as regards J. Barwell, jun.—Beacon Hill Pottery and Fire Brick Company, Poole, Dorsetshire.—Willinghall Co-operative Lock Company, Willenhall, lock manufacturers; as far as regards J. Dews.—Birkitt, Ward and Co., Derby, stove grate manufacturers; as far as regards R. Orme.—Davies and Jones, Lampeter, Cardiganshire, coal merchants.—Debenham and Spill, Bromley-by-Bow, button merchants; as far as regards D. Spill.—N. and L. Courlander, Richmond, Surrey, jewellers.

NEW COMPANIES.

BRITISH STEAMSHIP.—For carrying on the business of a shipowner in all branches, this company was registered 11th inst., with a capital of £60,000 in £50 shares.

COURT GRANGE UNITED SILVER LEAD MINING.—For carrying on mining operations in the county of Cardigan this company was registered 13th inst., with a capital of £30,000 in £1 shares.

GILLERTHWAITE IRON.—Registered 10th inst., with a capital of £10,000 in £5 shares, to take over and work the Gillerthwaite Iron Mine, situate in the parish of Ennerdale, Cumberland.

GLYNCORRWG COLLIERY.—This company proposes to take over the undertaking, business, and liabilities of an existing company of the same, carrying on business at Glyncorrwg, in South Wales. It was registered 13th inst., with a capital of £78,000 in £10 shares.

GOLD COMPANY OF SOUTHERN INDIA.—This company was registered 13th inst., with a capital of £100,000 in £1 shares, to acquire and work mineral property in India.

GREAT NORTHERN STEAMSHIP FISHING.—This company proposes to build a fleet of swift screw steamships to be used in the fishing trade. It was registered 13th inst., with a capital of £25,600 divided into 128 shares of £200 each.

HEMSWORTH COLLIERY.—This company was registered 16th inst., with a capital of £10,000 in £50 shares to acquire and work the Hemsworth Colliery, situate at Hemsworth, York. The purchase consideration is £6 500.

HULL STEAM FISHING AND ICE.—Registered 13th inst., with a capital of £30,000 in £25 shares, to build a fleet of steamers to be engaged in the fishing and ice trades.

NEW GOLD RUN.—This company proposes to acquire and work the Cedar and Sherman claims in the Gold Run District, near Gold Run, Placer County, California, and the assets and other property of the Gold Run Hydraulic Mining Company (Limited). The new company was registered 16th inst., with a capital of £60,000 in £1 shares.

SOMORROSTRO IRON ORE.—This is a reconstruction of an existing company of the same name, which was incorporated on the 17th June 1872, and is now in liquidation. The present company was registered 13th inst., with a capital of £75,000 in £5 shares.

SOUTH CARNARVONSHIRE GRANITE.—Upon terms of an agreement of 6th inst., this company proposes to purchase a lease of a stone quarry situate in the parish of Rhew, county of Carnarvon. It was registered 12th inst., with a capital of £10,000 in £5 shares. The purchase consideration is £3500 of which £2300 is payable by mortgage debentures of £25 each, bearing 7 per cent. per annum interest.

STEAMSHIP "ESCAMBIA."—Incorporated 16th inst., with a capital of £32,500 in £50 shares, to purchase and work the steamship *Escambia* of Liverpool.

WASTE METAL PRODUCTS.—Upon terms of an agreement of 12th inst., this company proposes to acquire and work the patented inventions of Adolf Gutensholm for "an improved process for the separation and utilisation of the tin and iron in tinned iron waste," and "improvements in galvanised generators, and in the application thereof to the utilisation of materials employed therein, and in obtaining products therefrom." The company was registered 15th inst., with a capital of £5000 in £5 shares.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

Metal Market, City, Wednesday Afternoon, 4 P.M.
(*March* 24, 1880.)

METALS AND ORES.

	MARCH 18. £ s.	£ s.	MARCH 24. £ s.	£ s.
COPPER (per ton)—				
Chili, for 96 per cent.	66 10/	—	66 0/	—
Wallaroo	82 0/	81 0/	79 0/	80 0/
Burra Burra	80 0/	—	79 0/	—
English Tough	74 0/	76 0/	73 0/	74 0/
English Ingot best	76 0/	77 0/	74 0/	75 0/
Sheets sheathing and rod	79 0/	81 0/	79 0/	—
Bottoms	84 0/	—	84 0/	—
Ore per unit	0 14/	0 14/6	0 13/4½	0 13/9
PHOSPHOR BRONZE				
Special Bearing Metal (p tn)	116 0/	—	116 0/	—
Other alloys (per ton	123 0/	139 0/	123 0/	139 0/
TIN (per ton)—				
Straits (Cash)	88 5/	—	84 10/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	93 0/	94 0/	93 0/	—
Do. Bars	94 0/	95 0/	93 0/	—
Do. Refined	96 0/	—	95 0/	—
Australian	88 5/	—	84 10/	—
TIN PLATES, per box, I.C. coke f.o.b. London	0 27/	0 30/	0 25/	0 28/
IX. do.	0 32/	0 35/	0 30/	0 33/
I.C. charcoal	0 30/	0 36/	0 28/	0 30/
I.X ,,	0 36/	0 40/	0 34/	0 36/
LEAD (per ton)—				
Soft English pig	17 10/	—	16 15/	—
Do. W.B.	—	—	—	—
Spanish soft	17 0/	—	16 10/	—
Do. with silver	—	—	—	—
Sheet milled	18 0/	—	17 10/	—
Red lead	17 10/	—	17 10/	—
White	22 0/	—	22 0/	—
Patent shot	20 10/	—	20 10/	—
ZINC (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 0/	—	23 10/	—
Do., foreign	24 0/	—	24 0/	—
SPELTER (per ton)—				
Silesian, com	20 15/	—	20 15/	—
Rhenish	—	—	—	—
English	—	—	—	—
QUICKSILVER, bot.	7 0/	—	7 0/	—
ANTIMONY ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	72 0/	—	72 0/	—
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
NICKEL (per lb.)	0 3/	—	0 3/	—
BRASS (per lb.)—				
Sheets, 48×24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8¼	—	0 0/8¼	—
Yellow metal	0 0/6½	—	0 0/6½	—
ASBESTOS (per lb.)	0 0/3	0 0/6¼	0 0/3	0 0/6¼
PLUMBAGO (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/	—	8 6/	—
COALS (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	MARCH 18. £ s.	£ s.	MARCH 24. £ s.	£ s.
IRON, per ton (at works)*—				
Bars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common	8 0/	—	7 15/	—
Do. Best	8 10/	9 0/	8 5/	—
Sheets, singles, Cleveland	10 5/	10 10/	10 0/	10 5/
Staffordshire	11 0/	11 10/	10 10/	—
Do. doubles, Staffordshire	12 10/	13 0/	12 0/	—
Do. Lattens, Staffordshire	14 0/	14 10/	13 10/	—
Plates, Ship, Stafford.	10 0/	10 5/	9 15/	—
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	11 0/	11 10/	10 10/	—
Hoops, Stafford	9 10/	10 0/	9 0/	9 10/
Nail Rods, Stafford	9 0/	—	9 0/	—
Swedish in Lond.	11 10/	—	11 10/	—
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 5/	6 10/	6 5/	6 10/
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	8 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow				
Scotch warrants	2 16/10	—	2 15/	—
Do. No. 1	3 1/	3 12/6	3 0/	—
Cleveland, Tyne or Tees	2 18/	3 5/	2 18/	3 5/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
SWEDISH IRON— f.o.b. Gottenburg, nett cash,				
Pig	—	—	—	—
Bar, rolled	11 10/	12 0/	11 10/	12 0/
Do. hammered	12 0/	12 10/	12 0/	12 10/
Billets	12 0/	—	12 0/	—
Horse Nail Rods	—	—	—	—
BELGIAN IRON—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	Nominal.			
Best				
Best Best				
Hammered				
Puddled Steel				
Bessemer				
Hoops				
Rails				
Rolled Girders				
STEEL—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	31 0/	21 0/	31 0/
Swedish keg	16 0/	—	16 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	10 5/	10 10/	10 5/	10 10/
SCRAP (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
WIRE—				
Best best drawn killed gal. tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14/6	—	0 14/6	—
Do. 7 to 8	0 15/	0 15/3	0 15/	0 15/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
CASTINGS (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 ,, 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 ,, 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 ,, 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 ,, 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

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* The entire ton consists of ten times 100 kilogrammes, or about 30 lb short of an English ton.

OILS, CHEMICALS, &c.

	MARCH 18. £ s.	£ s.	MARCH 24. £ s.	£ s.
OILS (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioja	45 0/	—	45 0/	—
Do. Levant	40 10/	41 0/	40 10/	—
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	45 0/	46 0/	45 0/	46 0/
Do. Sicily	45 0/	46 0/	45 0/	40 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	73 0/	75 0/	73 0/	75 0/
Cod	—	27 0/	26 0/	26 10/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	30 15/	—
Do. brown	28 10/	—	28 0/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	32 10/	33 0/	31 0/	—
Palm nut oil	34 0/	—	34 0/	—
Linseed oil	27 0/	—	26 15/	27 0/
Cotton seed oil	27 10/	28 10/	26 15/	27 5/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	37 0/	39 0/	36 0/	38 10/
Do. Ceylon	33 10/	—	33 0/	33 10/
Mauritius	37 10/	—	37 10/	—